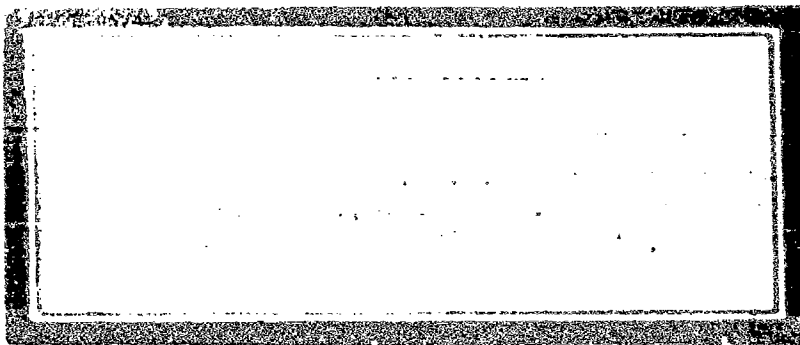


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NAVSHIPS 0900-001-4000

PROJECT SHARP
(SHips Analysis and Retrieval Project)
INFORMATION STORAGE AND RETRIEVAL SYSTEM:
COMPUTER ASPECTS AND PROGRAMS

91-8

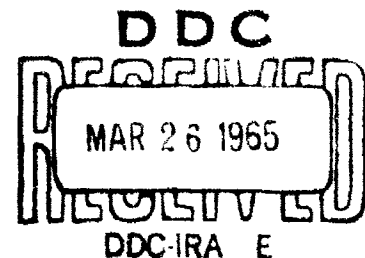
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CONTENTS

	Pages
List of Figures	iii
Abstract	iv
Chronological Summary	v
Introduction	1
The System	2
Library Catalog Cards	2
Library Accessions Bulletin	5
Periodical Control System	5
Bibliographic and Subject Matter Search	7
Master File Maintenance	8
The Search Strategy	11
Bureau of Ships Thesaurus	12
Engineers Joint Council-advocated Indexing System	13
Subject Matter Search	13
Bibliographic Search	14
Coordinated Search	19
The Routines	20
Bibliographic File Maintenance	20
Accessions Bulletin and Catalog Cards	21
Periodical File Maintenance	24
Subject Matter File Maintenance	27
Bibliographic and Subject Matter Search	27

	Page
Current Progress and Future Plans	31
Planned Extensions in Progress	31
Planned Improvements	32
References	35
Appendices	
A. Flow Diagrams	39
B. Role Definitions	43
C. File Formats and Key punching Instructions	55
D. Computer Operating Instructions	69
E. List of Programmers	79
F. List of Subject Codes	83

List of Figures

	Page
1. Catalog Card Format	3
2. Role Functions	10
3. Subject Matter Query Coding Sheet	15
4. Bibliographic Data Transmittal Sheet	16
5. Possible Query and Document Covering Period Intersections	18
6. Sample Page from a Library Bulletin	22
7. Sample 3x5 Library Catalog Cards	23
8. Sample Master List of Periodicals	25
9. Sample Periodical Status List	26
10a. Sample Domestic Subscription Renewal Form	28
10b. Sample Foreign Subscription Renewal Form	28
10c. Sample Service Subscription Renewal Form	28
11. Sample Subject Matter Master File Edit.	29
12. Sample Query Results Edit	30
13. Subject Matter Processing Sheet (In Appendix C)	63
14. Bibliographic Query Form (In Appendix C)	66
15. Periodical List Worksheet (In Appendix C)	68

ABSTRACT

SHARP is a computer oriented information storage and retrieval system developed to resolve some of the problems inherent in the handling, storage and retrieval of scientific and technical literature at the Bureau of Ships Technical Library. The computer is being used to automate to a high degree, (1) bibliographic searches (2) subject matter searches (3) coordinated searches (combinations of both) (4) issuance of library catalog cards and accessions bulletins (5) control of periodicals and journals (6) other aspects under development, such as, complete automatic generic computer searching, automatic posting of descriptive terms by the computer in the indexing procedure, and user interest registers. The system is intended to improve the library's capacity to better serve the user and to function as a management and logistics tool for the library. Details of the computer aspects of the indexing scheme, search strategy, thesaurus, computer programs, present research work are reported. Modifications to the system and future plans are indicated.

The results reported herein were obtained in the course of research supported by the Bureau of Ships, Department of the Navy under Project S-F-007-01-03, Task 0404, at the David Taylor Model Basin, Applied Mathematics Laboratory, Carderock, Md., a field activity of the Bureau of Ships. The report was originally prepared as DTMB Report No. 1923, and edited by Annie E. Cooper and Gilbert R. Gray of the Management Applications Branch, Applied Mathematics Laboratory.

CHRONOLOGICAL SUMMARY

Has a report been written on ELECT Inc.'s portion of Contract NObs 0000 covering the second quarter of fiscal 1964? Is there any technical literature on the use of computer oriented information retrieval systems to supply ships at sea with parts from tenders? To answer such questions accurately and rapidly is a prime function of the Bureau of Ships Technical Library. To better achieve this task the Library has been engaged in a cooperative project with the David Taylor Model Basin, Applied Mathematics Laboratory, to design, develop and test a computer-oriented information storage and retrieval system.

The following statements chronologically summarize the work on the project to date:

1960-1961

1. Specifications and plans for the conduct of the project were developed. Various proposals for a system were studied and it was agreed that the final system must have the capability to (a) automate and simulate, to a high degree, library functions on a computer; (b) retrieve from either or both, the subject matter and bibliographic approaches; (c) handle frequent updating and retrieval requests on the system files; and (d) utilize an indexing scheme that would permit indexing in depth.

1961-1963

2. This period was spent determining the indexing scheme to be used. Existing systems were studied. Concentrated efforts were made to ready FROLIC (Formal Retrieval-Oriented Language for Indexing Content) for computer implementation. Considerations of time and funds, however, eliminated FROLIC from immediate adaptation.

3. Being somewhat independent of the searching problem, the Library Accessions Bulletin and the 3x5 Catalog Cards were automated.

1963-1964

4. The Engineers Joint Council (EJC)-advocated system of links and roles was adopted as the indexing scheme.

5. The bibliographic and subject matter search systems were developed and tested on nearly 1000 subject indexed technical documents.

6. A computer system was developed and implemented to automate the handling of the control, inventory, renewal and routing of the library's periodicals and journals.

Many different analysts have worked on the various phases of project SHARP. The David Taylor Model Basin project managers have been Messrs. , Milton Siegel

(1960-1963) and Gilbert Gray (1964). Messrs., Thomas Walton and Larry Schmidt participated in the early development and are the authors of FROLIC. Mr. John Nicolaus, who directed the overall program, and Mrs. Ruth Camp, both of Bureau of Ships Technical Library, have been Library Science advisors to the David Taylor Model Basin.

The individual authors and their areas of responsibility follow:

Mrs. Natalie Goldberg - 3x5 Library Catalog Card and

Accessions Bulletin

Mr. Milton Siegel - Bibliographic and Subject Matter Search

Routines

Mr. Milton Siegel and Mr. Benny Wallis -

Periodical and Journal Inventory System

Mrs. Annie Cooper and Mr. Wayman Braxton -

Master File Maintenance Systems

Mrs. Annie Cooper and Mr. Gilbert Gray -

Search Strategy

Mrs. Annie Cooper and Mr. Gilbert Gray -

Current Progress and Future Plans

INTRODUCTION

Much has been written in the past several years concerning the extraordinary flood of scientific and technical information literature and the effect of this "Explosion" on the technological community. The discriminating retention of this information has created important problems for both large and small libraries whether in government or industry which do indeed bear the brunt of responsibility for supplying timely and needed document research and reference services. Hardest hit are those lacking manpower - and who does not lack manpower?

The Bureau of Ships Technical Library was no exception. The effect of this increased activity was noted by management and the green light was given to cope with the situation.

The impact was most noticeable in the area of technical reports and it is in this area that effective control, retrieval and timely dissemination is of prime importance to the Bureau, its field activities and contractors.

In order to provide a clearer appreciation of the varied functions and operations of the Library, it is important to understand the type of library it is -its mission -and to familiarize ourselves with the coverage of its holdings.

The Bureau of Ships Technical Library is a Major Technical Research Library. It is a Major Library since it provides an extension of the library function beyond its local unit organization. It is a Technical Research Library since it is predominantly devoted to science and engineering in more than one discipline and provides reference and referral services in support of studies in subject

fields related to research, development, test, engineering and evaluation.

The Bureau Library contains primarily material on naval architecture, shipbuilding, chemistry and chemical engineering, mathematics, mechanical, marine and electrical engineering, acoustics, electronics, hydromechanics, materials, metallurgy, optics, propulsion, and nuclear physics. In order to meet the needs of the entire Bureau, however, the reference sources are not limited to purely technical and scientific material. They include a workable collection of materials in the fields of management, industrial engineering, naval tactics, and languages. The collection consists of classified and unclassified material in the form of scientific and technical reports, books, periodicals, and miscellaneous publications. The Library is the central depository for the technical and scientific reports issued by the Bureau's field activities and contractors. Book publications are principally in English but are also, to a limited extent, in German, French, Swedish, Dutch and Russian. Most of the documents are domestic; however, since 1951, the Library has assumed bibliographic control of the foreign documents, technical, and scientific reports obtained from the Office of Naval Intelligence, or from offices abroad, either on a loan or on a retention basis. This collection now numbers 45,000 documents.

As of January 1963, the total collection numbered approximately 170,000 scientific and technical reports; 25,000 books and bound journals; 3,000 pamphlets covering industrial and government standards and publications of an ephemeral nature; 560 periodical titles are received of which 200 are bound annually. Approximately 30,000 of the older reports are on microcards, and the new Thomas' Register of Manufacturers catalogs are

being received on microfilm. In addition, a small number of military periodicals are also on microfilm. There is an annual increase of approximately 15,000 reports and 2,000 books and miscellaneous publications. The staff is presently comprised of 12 professional and 3 clerical personnel.

* * *

The foregoing is quoted from a report, Reference (4), by John J. Nicolaus, Librarian of the Bureau of Ships Technical Library. Full details of the SHARP System are contained in this report, and in order to obtain a complete picture and understanding of the operation of the System, it is recommended that it be read before perusal of the present document.

THE SYSTEM

The Project SHARP System has been initially designed for the IBM 7090 and 1401 computers. All basic processing is accomplished on the 7090 computer while printing, file copying, card-to-tape, etc., operations are carried out on the 1401 computer. The minimum configuration required includes:

IBM 7090

- a. 32K core memory
- b. two I/O channels
- c. four tape units attached to each channel
- d. on-line printer and card reader

IBM 1401

- a. 4K core memory
- b. one tape unit
- c. one-line printer and card reader

Software included IBM's IOCS and 9-Sort with the Bell Laboratory Monitoring Program (7090) and Autocoder (1401). The IBM 7090 computer was selected because of its speed, size and

availability. However, many other data processing computers on the market could do the job as well or better.

Currently, there are three SHARP master files to be maintained and eleven formal outputs. The master files are for the Bureau of Ships Technical Library's periodicals, technical document bibliographic data and corresponding technical document subject matter encoded data. Three of the outputs are designed to facilitate the maintenance of the three master files. Six of the outputs represent the mechanization of four routine, though basic, library functions - the preparation of library 3x5 catalog cards, technical document accessions bulletins, periodical accessions lists and periodical subscription order forms. The last two of the eleven outputs are the results of the bibliographic and subject matter searches.

Library Catalog Cards

In all probability catalog cards will still be used in mechanized library systems to answer simple reference questions, without resorting to computer searches, particularly when the user knows the source, report number, etc. Also, subject catalog cards will probably be maintained in order to encourage "browsing" which many users will no doubt find desirable. The object of this portion of the SHARP System is to automatically produce library cards, as a "by-product" of the accumulated bibliographic data, which were formerly typed and then reproduced by photography. Now a single IBM 1401 routine produces the library cards quicker and more accurately.

For each document received, eight unit catalog cards are produced to be used in source files, author files, contract number files, etc. In addition, up to six subject heading cards may be produced depending upon the individual document. The data that is printed on the 3x5 library catalog card is forwarded as additions or corrections to the basic SHARP Bibliographic master file. Figure 1 shows the format of a 3x5 card. The operation of the 3x5 routine is described below.

DESCRIPTOR (Subject Heading)		1 ACCESSION No.	
MAIN SOURCE			
SOURCE EXTENSION			
SOURCE'S REPORT NUMBER			
SECONDARY SOURCE			
SECONDARY SOURCE'S REPORT NUMBER			
TITLE OF REPORT OR DOCUMENT		2	
TITLE (Cont.)			
TITLE (Cont.)			
TITLE (Cont.)			
AUTHOR			
SECOND AUTHOR			
CONTRACT NUMBER	DATE OF PUB.		
TRANSLATION NUMBER			
BUREAU OF SHIPS PROGRAM NUMBER	TASK NUMBER		
2nd BUREAU OF SHIPS PROGRAM NUMBER	2nd TASK No.		
NAVAL ATTACHE INFORMATION REPORT NUMBER		PAGINATION	
DDC (ASTIA) AD NUMBER			
ONI REPORT NUMBER	Misc.		
BUREAU OF SHIPS ID NUMBER			
DESCRIPTOR (Subject Heading)			
DESCRIPTOR (Subject Heading)			
DESCRIPTOR (Subject Heading)			

(1. Report Security Classification. 2. Report Title Security Classification.)

Figure 1. Layout for 3 x 5 Library Catalog Card.

As each record is read into the computer, the information is edited and moved to its print positions. A check is made to see if the information is blank. If it is, the next information on that record is processed or a new record is read in. If the line is not blank, it is printed and then moved to a storage area to be used in printing the additional cards. The cards are printed two at a time so that all information is moved into two print areas and then moved from one of the two print areas into storage.

When a new record containing a card numbered 1 is sensed, the computer recognizes that this is the beginning of a new document. The program spaces to the beginning of the next 3x5 card (this is regulated by a special paper loop on the 1403 printer) and transfers the information in storage to the print areas. This process is repeated three times giving a total output of eight 3x5 cards. The program then checks to see if there were subject headings specified in card number 6. If so, the first two are moved to the top of the next 3x5 card and another two catalog cards are printed. This process is repeated for the third and fourth, and fifth and sixth subject headings. Should there be an odd number of subject headings pertaining to a given document, the second card is printed exactly like the basic cards, but cards are always printed two at a time.

Because of the limited space on a 3x5 catalog card, only sixteen lines plus the subject heading may be printed. There are certain exceptional cases when not all of the information pertaining to a given document can be contained on one 3x5 catalog card. When this occurs, the condition is sensed as the data is being moved to storage. The transfer of information to storage stops, the computer spaces to the top of the next 3x5 card form, the word "cont" is printed, and then the additional information is printed on two 3x5 cards. When a new record containing a card numbered 1 is sensed, the computer proceeds as was described

above, so that the eight basic cards are still printed, but only two of the continuation cards are printed.

All information is transferred from tape to the print area with change of format, except in two cases. In the case of an extension card containing the sources report number extension, only the first 22 of the 27 allowed characters are printed. This is under the assumption that a sources report number will never exceed 48 characters.

The second exception occurs in the case of the report title. The title may extend for 68 or 69 characters on a given input record. This is too long to fit on one line of a 3x5 card. Beginning in column 30 which is the 28th character of the title, a check is made for a blank. When a blank is sensed, indicating a division in words, the title is divided at that point. The first half is moved to the print area, printed, and moved to storage. This is then followed by the second half.

When the Report Security Classification of a document is "C" or "S" the word "CONFIDENTIAL" or "SECRET" is moved to the print area, printed, and then moved to storage. This follows all other information for the document.

A condensed self-loading program deck is used to run this problem. The input tape should be placed on tape unit 1.

A special paper loop is needed on the 1403 Printer. This control loop regulates the carriage control and insures proper spacing of the material to be printed. The format for this paper loop is as follows:

<u>Line</u>	<u>Channel</u>
1	1
2	2
20	2
38	2
56	2

<u>Line</u>	<u>Channel</u>
74	2
92	2
110	2

The control tape is cut at line 126, making the loop exactly 21 inches long, or the equivalent of seven 3x5 catalog cards.

In connection with the program, special paper stock is used on the 1403 Printer. This paper stock is perforated horizontally every three inches and vertically into two five inch cards. Thus the librarian can easily tear the output into the 3x5 library catalog card size.

The printing mechanism on the 1403 Printer must be horizontally adjusted to account for the narrower paper stock. The left hand tractor is moved to the extreme left and the horizontal vernier is then adjusted so that printing begins one character from the leftmost print position.

Library Accessions Bulletin

The Accessions Bulletin is one means by which Bureau of Ships' scientists and engineers are informed of the availability of new technical documents in the library. The bulletin contains bibliographic data about the new technical documents and is distributed to all Bureau codes and Bureau field activities. As new documents are added to the SHARP Bibliographic master file, they are also selected for editing in the Accessions Bulletin. The operation of the Library Accessions Bulletin routine is described below.

Input to the program is on tape with the exception of a header card which follows the condensed self-loading program deck. This header card is in the following format:

	<u>Cols</u>
Date (MM-DD-YY)	1-8
Volume	9-10

<u>Number</u>	<u>Cols</u>
11-12	
Blanks	13-80

At the outset of the program the heading information is read in via the header card and this information along with the title of the bulletin is printed. The volume and number are stored in memory to be printed at the beginning of each additional page.

The computer reads all records with card numbers of 1 through 4 and edits and stores in memory the following information: Source, Library Accession Number, Report Security Classification, Title, Author, Contract or Report Number, and Date of Publication. If the Report Security Classification is a "C", the word "CONFIDENTIAL" is also stored in memory with the above information.

Upon reaching a record with a card number of 5, a check is made to see if a new subject code has been reached. If it has, the new subject title is printed. The stored information is then moved line by line to the print area and printed on the 1403. At this point the program skips all records with card numbers of 6 and proceeds to process the next document in the manner described above.

A special paper control tape is used on the 1403 Printer to regulate the carriage control for this routine. The format for this paper loop is as follows:

<u>Line</u>	<u>Channel</u>
5	1
55	12
71	1
121	12

Periodical Control System

One of the burdensome chores of a technical library is that of maintaining inventory control over the many journals and periodicals to which it subscribes.

The SHARP Periodical Control System on the IBM 7090 has as its purpose the mechanization, to a high degree, procedures for:

- (a) Renewing periodical and journal subscriptions on schedule.
- (b) Updating changes in periodical titles, prices, quantities, etc.
- (c) Publishing periodical routing lists.

All periodical and journal data are maintained on the SHARP Periodical master file which is processed in various ways to produce three SHARP formal outputs.

The Periodical Renewal List is produced by an IBM 7090 routine which automatically processes separate domestic, foreign, and service type publications lists, giving the names, quantities, costs and subscription dates of the periodicals and journals. These lists are produced well in advance of the expiration dates, thus making it possible to accurately forecast, for any period of the fiscal year, expiration dates and funds required for purchases and renewals. The computer produced edit, not only gives the information as to titles, costs, etc., to the library, but serves as the enclosure to procurement requests and is forwarded to the agent or publisher. The routine also updates the SHARP Periodical master files as to expiration dates so that future passes through the file will only retrieve items which need to be ordered. The input to this routine is the SHARP Periodical master file and an expiration date card, and the outputs are the three separate order forms.

The Periodical Routing List is also produced by an IBM 7090 routine. The input is the SHARP Periodical master file and the output is an edit which gives the status of all periodicals and journals with regard to routing availability, library reference availability, location in the Bureau, etc. This edit is reproduced and routed to all Bureau codes.

The routine interprets the coded values of the master file parameters to produce the output. Periodicals having certain address codes are not selected for output. Those having an "S" in the type field and space for the binding code are also passed over. For those periodicals and journals selected, the title, addressee (if any) and routing code (check field) are put on the list. The routing code is defined as follows:

1. REF indicates the periodical is available in the library for reference and not routed.
2. N indicates the periodical is received irregularly and not routed.
3. "*" indicates the periodical is retained in the Bureau code (Division, Branch, etc.) shown.
4. " () " indicates the periodical is available and may be routed.
5. Blanks indicate the periodical is no longer available and the accompanying remarks should be noted.

The contents of the check field (cf) are determined as follows:

1. If publication frequency is I, then cf is N.
2. If reference code is R, binding code is B and quantity is greater than or equal to three, the cf is (). If quantity is less than three, cf is REF.
3. If type is S and binding code is B, then cf is REF.
4. If reference code is R, binding code is not B and quantity is greater than or equal to two, then cf is (). If quantity is less than two, cf is REF.
5. If reference code is not R, binding code is B and quantity is greater

than one, cf is (). If quantity equals one, than cf is REF.

6. If reference code is not R and binding is not B, and quantity is greater than or equal to one, cf is ().
7. If quantity is zero, and expiration date is blank cf is spaces.

Bibliographic and Subject Matter Search

One of the prime objectives of Project SHARP is to give the Bureau of Ships Technical Library the capability to effectively and quickly service requests from scientists and engineers for technical information. These requests could have a bibliographic and/or subject matter origin. Two SHARP master files (the Bibliographic and Subject Matter) and two IBM 7090 routines make up the major portion of the SHARP retrieval system. The bibliographic and subject matter searches are handled by separate but similar routines. In fact, the bibliographic retrieval routine was modified to produce the subject matter retrieval routine.

In general, the search routine requires the master file (subject matter or bibliographic as appropriate) and the encoded query as input. The query must include the field(s) to be searched (such as covering dates) the value(s) of the field (such as the second quarter of 1964) and the type of search or operation code(s) (such as "less than" or "equal"). Each query is coded as a series of query cards with each card pertaining to the same query having the same query number. If the fields and values on different cards have an AND relationship then the query cards have the same query and part numbers. If that relationship is an OR, then the part number will differ. Hence, each query card contains one combination of field, value and operation code which is linked (AND or OR) to other query cards by the query and part numbers.

For simple questions put to the system, one query card is required. The average bibliographic OR relationship search (different question or different part of the same question) requires 6 query cards. The average subject matter OR relationship search requires 3 query cards. The search routine can handle approximately 350 cards during one pass of the master file, hence 350 simple questions, 116 average subject matter questions or 59 average bibliographic questions can be answered during one pass (less than 5 minutes computer time) of the master file.

The search routine reads in all of the query cards (which are in query-part number sequence) first. As each card is read in, a small package of "search coding" is generated in the computer. This "search coding" package includes the proper extractors, fields, values, operation codes, compares, etc., necessary to interrogate the master file for the conditions posed on the query card. Generally, after 350 such packages have been generated, all of the available computer core has been allocated. After all query cards are read in, the master file is read. As each item of the master file is read, it is also matched against each "coding package". If an item does not match any query card in a group of AND cards, then that item is not compared against anymore of that AND group. If an item matches all of the cards of an AND group, then a "hit" is scored and the item is selected as answering the query. In this way, the master file is passed only once. The speed of the IBM 7090 computer allows the search to be made in the time that it takes the computer to read the query cards and master file, and print out the answer. Hence, the routine is input/output limited.

Bibliographic searches may be made on the following fields or any combination of these fields:

1. Document Security Classification and Accession Number

2. Source or Originating Activity
3. Source or Originator's Report Number
4. Personal Author(s)
5. Contract, Grant, Economy and Laboratory Project Number(s)
6. Covering or Inclusive Dates of a Report
7. Report Date or Date of Publication
8. Bureau of Ships Project, Subproject and Task Number(s) and/or other Agency Project Number(s)
9. Defense Documentation Center Accession Document (AD) number(s)
10. Defense Documentation Center Availability/Distribution Limitation.

Subject matter searches may be made on any combination of descriptors in the Bureau of Ships Library Thesaurus, Reference (3). The subject matter search routine not only expects the query cards to list the descriptors, but also expects the syntactical relationships between them to be indicated in terms of the roles. If such deep searching is not required, then each descriptor may be searched in every role, thus eliminating syntactical relationships. The operation codes for the searches are:

- | | |
|--------------------------|------|
| a. Equal | (E) |
| b. Not Equal | (NE) |
| c. Less Than | (L) |
| d. Greater Than | (G) |
| e. Less Than or Equal | (LE) |
| f. Greater Than or Equal | (GE) |

The outputs of the search routine are the accession numbers of the documents retrieved and the query and part numbers

of the questions answered. A more elaborate and personal output is obtained by matching the above output against the SHARP Bibliographic master file, selecting the bibliographic data for each accession number, sorting this data by query and part numbers, editing the data and distributing to each user his personal copy of the bibliographic data for his question only. This personalized output may be requested for both subject matter and bibliographic searches.

Master File Maintenance

Basically the three SHARP master files are maintained in the same manner that most data processing magnetic files are maintained, namely:

- a. New entries for the files are computer-checked for obvious format and inconsistency errors.
- b. Additions, deletions and changes are made via the computer, as required.
- c. Special master file edits are produced to aid cognizant personnel in keeping abreast of the file status.
- d. A sufficient number of current and back copies of the files are kept.

These files are maintained on the IBM 7090 computer. For each file there is (1) a format check routine, which examines appropriate file fields for numeric values, alphabetic contents, restricted ranges, and entries, etc.; (2) a sort routine which sequences all file data before entries are made; (3) an update routine which adds, deletes and/or corrects entries of the master file and; (4) an edit routine which prints out all or part of the master file for review or perusal.

The SHARP Bibliographic Master File contains bibliographic data of technical documents in the Bureau of Ships Library collection. The fields on this file

include author(s), source(s), accession number, title, security classification and many others. The general file design requires that each technical document be represented by no fewer than six basic cards numbered card 1 through card 6. Each such card contains the basic information for a set of fields from the file, for example, card 1 contains the name of the Source and Report Number; card 2 contains the Report Title and Security Classification of the Title; etc. Of course, each card contains the necessary data (security classification, accession number, card number and subcard number) to link the various cards for a given document. When any field of information on a card either requires more columns than are available on the card format (such as a Report Title extending beyond 68 digits) or requires more than one entry (such as 2 or more authors), then extension cards are used. The extension cards contain the additional information, and are linked and counted by their subcard numbers which range from 1 (first extension) to 9 (limit of extensions). Each of the basic 6 cards has a subcard value of zero. Codes are used to indicate whether the extension cards contain new entries in the field or left over data from other cards. Not all fields may be extended and some may be extended in only one way. Hence, from 6 to 60 cards represent a technical document in the SHARP Bibliographic file.

The SHARP Subject Matter Master File contains codes descriptors which describes the contents of technical documents. These descriptors are grouped by "link" and within the link are positioned as "roles". In general, a link represents a coded "pseudo sentence(s)" describing one intellectual relationship. As applied in Project SHARP a link might represent the indexing of a major theme or a major subdivision of the ideas, topics or findings of a technical document. Roles (see Figure 2) indicate the function or "part of speech" that descriptors play in links or "sentences". Roles and links are used in Project SHARP according to the general definitions and rules developed

by the Engineers Joint Council (EJC). The general design of the master file requires that descriptors are punched in columns according to their role value. Each card in the file will hold one descriptor for each role. Each card also contains the security classification and accession number of the indexed technical document plus the linkage code, card number and subcard number. The system allows for a maximum of 26 (A to Z) links for a single document and a maximum of 30 cards (which means 30 descriptors in each role) for each link. Hence a technical document may be subject indexed with from 1 to 780 cards. The number of cards per link is counted by the subcard number as 0, 1, 2, . . . 9, A, B, C. . . . The descriptors are 7 character alpha codes which are taken from the Bureau of Ships Thesaurus, and identifier numeric codes of the Defense Documentation Center Identifier Thesaurus Code Manual, Reference (14). (In addition, combinations of the foregoing are used to form alphanumeric identifiers.) These represent, therefore, general and specific descriptive scientific terms and identifiers (sometimes referred to as "open-ended" terms) used to index the Bureau's technical literature.

The SHARP Periodical Master File contains logistics data on all Bureau of Ships Library periodicals and journals. Included are such information as periodical cost, quantity, publication frequency, and routing code. The general design of this file requires that 2 cards, linked by title code (unique for each periodical) and card number, represent each periodical or journal in the library. Transmittal of changes and new records for the file must include all corrected fields (both cards). Deletions from the file require only 1 card each with the title code. The contents of the data fields may be interpreted as follows:

1. Reference Code (REF)

- a. "R" indicates a reference copy retained in the library

<u>ROLE NUMBER</u>	<u>DESCRIPTION</u>
8	Primary topics; principal subjects
1	Inputs
2	Outputs
3	Undesirables; unnecessaries
4	Present, possible and later uses
5	Media; adverbs; adjectives; geographic locations
6	Independent variables; causes
7	Dependent variables; effects
9	Passive recipients; location
10	Means of accomplishment
0	Document accession number (Bibliographic data)

Figure 2. Role Functions

- | | |
|---|---|
| <p>b. "Δ" indicates a reference copy is not retained.</p> <p>c. "N" indicates not routed.</p> <p>2. Binding Code (BND)</p> <p>a. "B" indicates a copy is reserved for binding</p> <p>b. "1" indicates a copy is retained for one year</p> <p>c. "2" indicates a copy is retained for two years, etc.</p> <p>d. "Δ" indicates a copy is not reserved for binding</p> | <p>3. Title</p> <p>This field usually contains the title of the periodical. If it is desired to retain a superseded title of a periodical in the current master file, then a fictitious periodical record is created and the title field contains:</p> <p>a. Old title</p> <p>b. "see"</p> <p>c. Current title</p> <p>4. Routing Code (RTG)</p> |
|---|---|

- a. "M" indicates that the periodical is mailed directly to the Bureau code designated in the addressee field
- b. "L" indicates that the periodical is mailed directly to the library.

5. Type Code (TYP)

- a. "D" indicates domestic periodicals
- b. "F" indicates foreign periodicals
- c. "S" indicates service periodicals
- d. "G" indicates gratis periodicals

6. Publication Frequency (FQ)

- a. "D" for daily
- b. "W" for weekly
- c. "BW" for bi-weekly
- d. "M" for monthly
- e. "BM" for bi-monthly
- f. "SM" for semi-monthly
- g. "SA" for semi-annually
- h. "A" for annually
- i. "Q" for quarterly
- j. "I" for irregular
- k. "X" for exceptions

7. Renewal Frequency (FR)

This field contains the renewal interval in years,

8. Expiration Date (YYMMDD)

This field contains the date on which subscription expires. YY = year, MM = month, and DD = day.

9. Title Code (ID number)

A numeric code assigned to each periodical to uniquely identify the periodical and to preserve the alphabetic sequence by title.

10. Quantity (QTY)

This field contains a number which indicates how many copies of a periodical are received by the library.

11. Unit Cost (XXXXYY)

This field contains the cost per periodical and XXXX = dollars while YY = cents.

12. PR Number

This field contains the procurement request number under which the periodical was ordered.

Each SHARP file is maintained on magnetic tape. A physical record on tape contains the data for a technical document, a link, or a periodical, respectively, in the Bibliographic, Subject Matter or Periodical file. Subject information and bibliographic data about each technical document are recorded in the Subject Matter and Bibliographic files respectively, and are cross referenced by security classification and accession number keys. The file formats and key punch instructions are listed in Appendix C.

THE SEARCH STRATEGY

The term "search strategy" refers to the totality of procedures and facilities

required to initiate and complete a library search. Briefly, in project SHARP, this involves the following:

1. Technical literature is received by the library, indexed, and forwarded to David Taylor Model Basin for inclusion in the Bibliographic and Subject Matter files.
2. Technical questions are received from the users.
3. Librarians interpret the bibliographic and/or subject matter nature of the questions and submit appropriate SHARP query forms to David Taylor Model Basin. The Bureau of Ships Thesaurus and the Engineers Joint Council manuals are used as guides in this step and in step 1 above.
4. David Taylor Model Basin formats the queries into IBM cards indicating their AND or OR relationships.
5. The query cards are processed against the Bibliographic or Subject Matter file on the IBM 7090 computer and the accession number and user identification of all "hits" are printed on-line and on tape. The tape output may be sorted and used to edit "personal" reports for each user.

To accomplish the above, key punching, card-to-tape, tape printing and digital computing facilities are used. Some of the more difficult aspects of the above, include coordination between the process of indexing the general text of the documents, and indexing specific questions in such a manner that the maximum number of relevant "hits" will be scored during the searches. This report is primarily concerned with the computer portion of project SHARP. References (4) and (10) give details of the other

aspects of the search strategy.

Bureau of Ships Thesaurus

The Bureau of Ships Thesaurus serves two purposes. First, it is a guide to technical terms, their synonyms and their hierarchical relationships. As such, the Thesaurus is an indexing tool for both storage and retrieval. It is a code book of descriptors and a focal point for efficient vocabulary development and expansion. Second, the Thesaurus is a means of descriptor and vocabulary control, so important in computer oriented systems. All questions as to proper spelling and meaning (with respect to interrelationship of terms) are resolved by the Thesaurus. The terms that are included, are general scientific and engineering words and special terms peculiar to the subject areas and functions of the Bureau of Ships.

The relationships of terms, shown in the Thesaurus are synonymous, hierarchical, and general. They are designated by the words "use", "includes", "broader terms", "narrower terms", and "related terms".

Synonymous relationships are indicated by:

1. "use" to specify the term (with the same or nearly the same meaning), selected by convention, to be used.
2. "includes" to specify other terms, in the Thesaurus, which have similar meaning, have become obsolete or outmoded and have variant forms and abbreviations.

Hierarchical relationships are indicated by:

1. "broader terms" to specify those terms which embody or cover the present term.
2. "narrower terms" to specify those terms, which the present term

embodies or covers.

General relationships are indicated by:

1. "related terms" to indicate popular and/or restricted association, frequent usage, etc.

The Thesaurus also contains definitions and remarks as scope notes, which are used to distinguish between identical terms with different meanings, to define unfamiliar terms, to limit the definitions of terms and to provide special instructions as to the use of certain terms.

Engineers Joint Council-advocated Indexing System

Reference (6) explains the details of EJC's indexing system of links and roles. A brief summary of the rationale of this system will be given here. Scientists and engineers use words to communicate ideas and facts and any simple indexing scheme would use these words or some unique transformation thereof. But words alone would not suffice, unless they were grouped (or linked) together to convey, at least intellectual relationships. These intellectual relationships could be crystallized into more definite meaning, if the function (or role) of each word were known and specified. In this manner, terms grouped together as links with role indicators simulate "sentences" in which the "parts of speech" correspond to roles.

As a storage and retrieval tool, this indexing scheme has simple logic which is intuitively valid. If the words of two "sentences" are merely listed together, the meaning and information conveyed is less precise and confused, than if the two sets of words were listed separately. For example, if "U.S." and "economy" were in one "sentence" and "England" and "war" were in the other, having all four words listed together, the topics under

discussion might be construed to be (1) English economy, (2) U.S. economy, (3) U.S. - English economy, (4) U.S. - English war, (5) war economy, etc. If the function of each word, could be indicated, then it would be possible to convey still more discriminant meaning and precise information. Assigning roles to words roughly corresponds to arranging the words into "sentences". For example, the words "chamber" and "music" without functions assigned, would raise the question, "chamber music" or "music chamber?" - two related, but different subjects.

The EJC system is adaptable to both manual and automatic implementation. As a manual operation, the indexed data should be available in several sequences (one each for role-major, link-major, accession number-major and descriptor-major) to allow easy manual searching. As an automatic operation, the indexed file should associate accession number and link so that all of the terms within a query (having an AND relationship) may be searched on a link basis for the documents. The EJC scheme, as applied in project SHARP, allows up to 26 links (A to Z) for each document and uses the ten role indicators summarized in figure 2. The meaning and explanations of the roles in Appendix B are taken from Reference (4).

Subject Matter Search

The subject matter search is accomplished by one routine (run 25). The inputs are the query cards and the Subject Matter Master File. The output is the on-line printout of accession numbers and query-part numbers of all search "hits" and the same information on tape which may be used to select the bibliographic data of the "hits".

Query cards represent the encoding of a question. The process of encoding requires the indexer to determine (1) how many simple queries (or OR relationships) into which the original question

should be formatted, (2) what terms will be used and (3) into which roles the terms will be placed. The indexer uses the top half of the query coding sheet (Figure 3). A coder fills in the bottom half of hits worksheet, consulting the Thesaurus for proper spelling of codes. Each descriptor and its role can be determined from the query coding sheet. The descriptor - role combinations found on the same sheet have an AND relationship, while those on separate sheets have an OR relationship. The OR relationship is required for (1) entirely different questions, (2) different parts of the same question or (3) different strategies for answering a single question.

Query cards are coded and key punched from the query coding sheets, according to format requirements of the search routine. The cards contain the following fields:

1. Line number
2. Query number
3. Part number
4. Role number
5. Operation code
6. Descriptor

The search routine requires that all cards having an AND relationship be consecutive. The line number field, which is numbered consecutively, is used to facilitate card handling and is not looked at by the search routine. The query and part fields are used to identify the query and its parts, and by the search routine to determine AND or OR relationships between the cards. The operation code indicates to the search routine the type of compare (equal, not equal, less than, etc.) required between the descriptors on the query cards and the master file.

Any combination of descriptors and roles may be subject matter searched. All combinations having the same query and part number are matched link by link against the master file. Searches across links nullify the indexing scheme. Hence, the AND relationship corresponds to a link in query encoding. It is not necessary that the query cards contain all of the terms within a link before a document is selected on the basis of that link, but rather that the link contains all of the descriptor-role combinations of the AND query cards. As mentioned earlier, the search routine can process about 350 query cards during one pass of the master file.

If the bibliographic data of the "hits" are required, three additional routines must be run. The first routine (run 22) eliminates duplicate accession numbers picked up when one AND combination selects the same document several times based on the query matching several links of that document. Run 22 also selects the bibliographic data from the Bibliographic Master File. The second routine (run 23) sorts the bibliographic data on query, part and accession numbers. The third routine (run 24) edits the data for transmittal to the user. The edit puts the answers for different users on different pages.

Bibliographic Search

The elements of the bibliographic search correspond closely to those of the subject matter search. The bibliographic search is also accomplished by one routine, the routine that was modified to create the subject matter search. The inputs to this routine are the bibliographic query cards and the Bibliographic Master File. The output is a list of the accession, query and part numbers of the search "hits" printed on-line and on tape.

Bibliographic query sheets are submitted by the Bureau on the forms (Figure 4) used to submit data for the Bibliographic

BUSHIPS TECH. LIBRARY - PROJECT SHARP		REQUESTER _____	DATE _____	QUERY NUMBER
QUERY SHEET (1-6)		CODE _____	EXTENSION _____	CODER

BUSHIPS TECH. LIBRARY - PROJECT SHARP - Query Coding Sheet (1-6)

ROLE 0	ROLE 1	ROLE 2	ROLE 3	ROLE 4	ROLE 5	ROLE 6	ROLE 7	ROLE 9	ROLE 10
PRIMARY TOPICS PRINCIPAL SUBJECTS	INPUTS	OUTPUTS	UNDESIRABLES UNNECESSARIES	PRESENT, POSSIBLE, and LATER USES	MEDIA/ADVERBS; ADJECTIVES GEOG. LOC's	INDEPENDENT VARIABLES CAUSES	DEPENDENT VARIABLES EFFECTS	PASSIVE RECIPIENTS LOCATION	MEANS OF ACCOMP. LISHMENT
1-7	8-14	15-21	22-28	29-35	36-42	43-49	50-56	57-63	64-76
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									

Figure 3. Subject Matter Query Coding Sheet

(1) SEC. CL. & ACC. NO.	(3) SOURCE RPT. NO.	(4) R.T.S. CLASS.
(2) SOURCE		DATE
(5) TITLE		3X5 CARDS YES NO
(6) AUTHOR		SOURCE CODE
(7) CONTRACT, ECON., OR PROJ. NO.		

CARD 4

COVERING DATE	DATE PUB.	TRANSLATION NUMBER	BUSHIPS PROG. NO.	TASK NO.	NA REPORT NO.	CARD NO.
						40
						41
						42
						43

CARD 5

PAGE	DOC (ASTIA) DOCUMENT NO.	ONI NUMBER	BUSHIPS ID NO.	LIM	OTS	MICR	SUB CODE	CARD NO.
								50
								51

CARD 6

SUBJECT	SUBJECT	SUBJECT	CARD NO.
			60
			61

Remarks:

LIBRARY DATA TRANSMITTAL
NAVSHIPS 6808 (9-65)

Figure 4.

Master File. As a query sheet, the question is filled in the remarks block, at the bottom of the form, and the values of the fields to be searched are placed in their appropriate blocks. When a range in values is involved, the upper and lower bounds are both listed in the proper field block. Query cards are formulated from these worksheets. Generally, each worksheet represents AND relationships between the fields marked. However, because of ranges in values, for some fields, it may be necessary to formulate OR relationships to completely answer the question. Examples of this are given later.

Query cards contain the following fields:

1. Line number
2. Query number
3. Part number
4. Field code
5. Operation code
6. Field value

The line number, which is not looked at by the search routine, is put in to

facilitate card handling since all AND related cards must be together. The query and part number fields are used to identify the query and its parts, and are also used by the search routine to determine AND and OR relationships. The field code is a number to indicate the field (author, source, security classification, etc.) to be searched. The operation code (equal, not equal, less, etc.) indicates the type of compare required. The field value is the actual value (author's name, publication date, etc.) to be compared by the search routine.

One problem, associated with the bibliographic search, is that of proper spelling when searches are made on such fields as author and contract number. Since the search routine matches each field character by character, no variation in spelling is allowed between the query card and the master file. For example, A. T. Brown is different from A. T. Browne, is different from Brown, A. T. is different from Art T. Brown, etc.

When a question involves a range of values on a search field, at least two query cards on that field will be required. For example, if the question is "list all documents by A. T. Brown published in the last quarter of FY 63," then three query cards are necessary:

<u>Line No.</u>	<u>Field</u>	<u>Operation</u>	<u>Value</u>	<u>Query</u>	<u>Part</u>
1	Author	=	A. T. Brown	1	1
2	Publication Date	>	3/31/64	1	1
3	Publication Date	<	7/1/64	1	1

Questions involving ranges on covering dates require special attention because every document, whose covering period intersects

the covering period on the query card, should be selected. Four possible variations of this may occur, as illustrated in Figure 5.

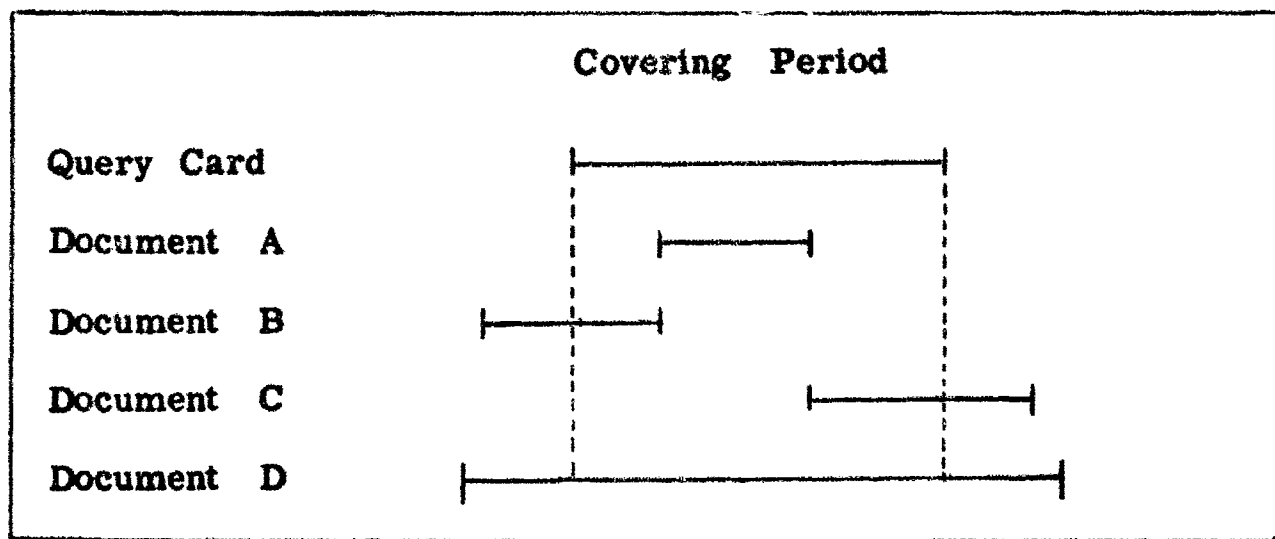


Figure 5. Possible Query and Document Covering Period Intersections

In case A the document covering date falls within the covering date of the query. In case B the document's covering period starts before the covering period of the query and ends within it. In case C the document's covering period starts within the covering period of the query and ends outside of it. And in case D, the document's

covering period starts before and ends after the covering period of the query. Each query involving the covering period must make allowance for these possibilities. For example, if the question were "list the documents of A. T. Brown with a covering period of 1 Jan 64 to 1 May 64", then the following search strategies will suffice:

<u>Line No.</u>	<u>Field</u>	<u>Operation</u>	<u>Value</u>	<u>Query</u>	<u>Part</u>	<u>Case</u>
1	Author	=	A. T. Brown	1	1	A&B
2	End Covering Date	≥	1/1/64	1	1	A&B
3	End Covering Date	≤	5/1/64	1	1	A&B
4	Author	=	A. T. Brown	1	2	A&B
5	Start Covering Date	≥	1/1/64	1	2	A&B
6	Start Covering Date	≤	5/1/64	1	2	A&B
7	Author	=	A. T. Brown	1	3	D
8	Start Covering Date	≤	1/1/64	1	3	D
9	End Covering Date	≥	5/1/64	1	3	D

Coordinated Search

A coordinated search is one requiring both the subject matter and bibliographic search routines. For example, "List all reports on mathematical development of ship lines published in 1960 and 1961 by David Taylor Model Basin or Navy Electronics Laboratory." Such a question may be answered by a subject matter search (or bibliographic search) first, followed by a bibliographic (or subject matter) search based on the results of the former search.

Which search should be accomplished first? In general, the first one should be that which will eliminate the largest number of documents. In the example above, a subject matter

search on "mathematical development of ship lines" should net far fewer hits than a bibliographic search on "reports by DTMB or NEL in 1960 and 1961." Hence, in this case, the subject matter should be run first. The results of this can then be run through the bibliographic search. In many cases during a coordinated search, a second one would not be required since the number of "hits" for the first are so few that a glance at these "hits" suffice for the second. This is particularly true when the first search is the subject matter search.

Coordinated searches are indicated by the Bureau of Ships by the transmittal of both subject matter and bibliographic

query coding sheets. The same query and part numbers are used on both forms. In order to keep the "noise" at a minimum, coordinated searches should be run separately. For example, if the "ship lines" question is run with several other questions, for instance as a subject matter search first, then the results of these questions may have documents, other than the "ship lines" answer, which meet the bibliographic requirements, namely, published by DTMB or NEL in the 1960-61 period. All such documents, other than the "ship lines" answers constitute "noise". This kind of "noise" is avoided by either processing coordinated queries alone or by selecting off the accession numbers of the coordinated search before the second half of the coordinated search is started.

THE ROUTINES

Often, in information retrieval systems, a prime goal is real time operations using random access devices and techniques. The motivation for such a goal is usually a combination of the following factors:

1. The problem to be solved has an instant response requirement 24 hours a day.
2. The problem has an immense data base.
3. The computer used has been procured to solve the one problem only.
4. The computer used has interrupt and extensive random access features.
5. The problem is monitored and maintained by highly specialized personnel.

In the case of project SHARP, the second factor applies. After several

thousand documents have been placed on both the Subject Matter and Bibliographic Master files, SHARP's data base will require several reels. Daily or twice daily responses will probably suffice for batched queries from the library. Project SHARP shares David Taylor Model Basin computers and facilities with over 300 other problems which require from 1 minute to 40 hours of computer time. Hence, an efficient operation using the principle of modularity has been the goal in project SHARP.

At present, 27 routines make up the SHARP computer system. Six are sorts, seven are edits and fourteen are search, updating and general processing routines. These routines are linked together modularly so that separate operations (updates, searches, sorts, edits, etc.) may be performed independently of each other, depending on the nature of the requests for service and the amount of computer time available. In general, each routine processes its files in less than three (3) minutes. When the maximum number of query cards are being processed by a search routine, the processing time is about 3 minutes per 1000 documents.

Bibliographic File Maintenance

The maintenance system for the Bibliographic Master File consists of Routines 1 thru 3, a sort, a format check, and an update routine.

Routine 1 - Sort

Routine 1 is an IBM 7090 generated sort (9-sort). The fields sequenced are security classification, accession number, card number and subcard number.

Routine 2 - Format and Consistency Check

The SHARP Bibliographic record consists of at least six cards, numbered 1 thru 6, representing a document. Each

card contains major data fields, such as, author, title, etc., and when the data field exceeds the number of columns on a single card, then additional cards (subcards), having the same card number, are used. This routine checks the validity of the data fields and the presence of all proper cards. Errors found are put on tape and appropriate on-line printouts are made.

Routine 3 - Update

This routine updates the Bibliographic Master File by adding new, deleting obsolete and/or changing incorrect items. Error conditions exist when this routine (1) attempts to add to the master file an item which is already on the file or (2) attempts to delete an item which is not in the file.

All of the data for a document may be deleted at once by inserting "ZZZZZZ" in columns 1 to 6 of the correction card. Certain fields and cards may be deleted individually by inserting "\$\$\$\$\$\$" in appropriate delete cards.

Accessions Bulletin and Catalog Cards

Routines 4 thru 9 are the programs that produce the 3x5 Library Catalog Cards and edit the Library Accessions Bulletin.

Routine 4 - Sort

Routine 4 is an IBM 7090 generated sort. The keys sequenced by this routine are security classification and accession number. This sort prepares the data for the format check. The input is a list of cards containing security classification, accession number, subject code and selection code of documents to be edited as 3x5 cards and/or accessions bulletins.

Routine 5 - Format Check

This routine verifies the format of the work list described above and (at the same time) by matching the list against the Sharp Bibliographic Master File selects the appropriate data from the file, inserting the proper subject code. Before the data goes to output the selection code is examined. If the code is a "1", the items are put on output 1 only, if it is a "2" the items are put on output 2 only and if it is a "3", the items are put on both outputs. Output 1 file is then processed for the Library Accessions Bulletins and output 2 is processed for the 3x5 catalog cards.

Routine 6 - Sort

Routine 6 is an IBM 7090 generated sort. The keys for sequencing are subject code, security classification, accession number, card and subcard number.

Routine 7 - Separate by Class

Routine 7 is designed to separate the classified data from the unclassified to facilitate handling. This routine checks the security classification field and if it finds a "C" or "S", the data is put on the first output file. If a "U" appears in the field, the records are written on output 2 file. An on-line printout occurs giving the number of records on each file at the end of the run.

Routine 8 - Edit

Routine 8 is the edit for the Technical Library Bulletin. This routine is programmed for the IBM 1401. The heading information is read into the 1401 computer via header card and stored in memory to be printed at the beginning of each page. The computer then reads all records with card numbers 1-5 and edits the necessary fields. All records with card number 6 are skipped. See Figure 6.

BUREAU OF SHIPS
TECHNICAL LIBRARY BULLETIN

VOL. 19, NO. 3

02-25-64

LIBRARY
NUMBER

TECHNICAL REPORTS
BASIC MATERIALS, PROCESSES AND PRINCIPLES

NAVAL BOILER AND TURBINE LABORATORY. PROJECT A-498. SODIUM SULFITE WATER TREATMENT ON THE CVA-60 BOILER REVIEW OF THE RESULTS OF THE INVESTIGATION. PRELIMINARY REPORT. MURDOCK, J. W. 7.29.63	U103497
STANFORD RESEARCH INSTITUTE. NOVEL HEAT-RESISTANT HYDRAULIC FLUIDS. MONTHLY REPORT NO. 11, 28 SEPTEMBER--27 OCTOBER 1963. CONTRACT NOBS 88248. 7 NOVEMBER 1963. (S-R001-03-01)	U103567
STANFORD RESEARCH INSTITUTE. NOVEL-RESISTANT HYDRAULIC FLUIDS. MONTHLY REPORT NO. 12, 28 OCTOBER--27 NOVEMBER 1963. CONTRACT NOBS 88248. 11 DECEMBER 1963. (S-R001-03-01)	U103575
NAVY MARINE ENGINEERING LABORATORY. LETTER REPORT 75 134F. INVESTIGATION OF EXPERIMENTAL MANGANESE-SILICON THERMO- ELEMENTS. RESEARCH AND DEVELOPMENT REPORT. OFFICIAL USE ONLY 11.04.63	U103580
STANFORD RESEARCH INSTITUTE. THERMOELECTRIC MATERIALS. QUARTERLY PROGRESS REPORT NO. 2, 8 JULY--8 OCTOBER 1963. CONTRACT NOBS 88487. 1 NOVEMBER 1963. (S-R007-12-01)	U103586
QUANTUM, INC. DEVELOPMENT OF TREATMENTS PRODUCING LOW-FRICTION SURFACES ON ELASTOMERS. FINAL REPORT, 15 FEBRUARY-- 30 NOVEMBER 1963. CONTRACT NOBS 84503. (S-R007-03-03. TASK 1003) 1.03.64	U103883

Figure 6. Sample Page from a Library Bulletin

HYDROFOIL BOATS	HYDRODYNAMICS
GRUMMAN AIRCRAFT ENGINEERING CORPORATION. U104210	GRUMMAN AIRCRAFT ENGINEERING CORPORATION. U104210
REPORT XAR-A-45.	REPORT XAR-A-45.
EXPERIMENTAL STUDY OF HIGH SPEED	EXPERIMENTAL STUDY OF HIGH SPEED
HYDROFOILS. VOLUME I.	HYDROFOILS. VOLUME I.
PARTS I-III. WITH APPENDICES.	PARTS I-III. WITH APPENDICES.
WRIGHT, H.A.	WRIGHT, H.A.
NOBS 84454	NOBS 84454
8.26.63	8.26.63
COIV	COIV
HYDROFOIL BOATS	HYDROFOIL BOATS
HYDROFOIL BOATS-DESIGN HYDROFOILS	HYDROFOIL BOATS-DESIGN HYDROFOILS
MATHEMATICAL ANALYSIS CONTRACT NOBS 84454	MATHEMATICAL ANALYSIS CONTRACT NOBS 84454

HYDROFOIL BOATS-DESIGN	HYDROFOILS
GRUMMAN AIRCRAFT ENGINEERING CORPORATION. U104210	GRUMMAN AIRCRAFT ENGINEERING CORPORATION. U104210
REPORT XAR-A-45.	REPORT XAR-A-45.
EXPERIMENTAL STUDY OF HIGH SPEED	EXPERIMENTAL STUDY OF HIGH SPEED
HYDROFOILS. VOLUME I.	HYDROFOILS. VOLUME I.
PARTS I-III. WITH APPENDICES.	PARTS I-III. WITH APPENDICES.
WRIGHT, H.A.	WRIGHT, H.A.
NOBS 84454	NOBS 84454
8.26.63	8.26.63
COIV	COIV
HYDROFOIL BOATS	HYDROFOIL BOATS
HYDROFOIL BOATS-DESIGN HYDROFOILS	HYDROFOIL BOATS-DESIGN HYDROFOILS
MATHEMATICAL ANALYSIS CONTRACT NOBS 84454	MATHEMATICAL ANALYSIS CONTRACT NOBS 84454

Figure 7. Sample 3x5 Library Catalog Cards

Routine 9 - Edit

Routine 9 performs the editing of the 3x5 catalog cards for the Bureau of Ships Technical Library. All information pertaining to a given document and stored on the input tape is reproduced on the 3x5 catalog card. For each document this program reproduces eight 3x5 unit catalog cards. In addition, up to six subject headings may be produced depending upon the individual document. See Figure 7.

Periodical File Maintenance

Six routines are needed to produce an updated Periodical Master File, which is then used to produce (1) a Master List of Periodicals, (Report 1); the Periodical Status List, (Report 2); and (3) Domestic, Service and Foreign Order Forms, (Reports 3A, 3B, and 3C). See Appendix A. The programs used for maintaining the system and producing the reports are Routines 10 thru 15. These routines are briefly described below.

Routine 10 - Sort

Routine 10 is an IBM 7090 generated sort used to sequence correction cards that have been punched from the marked-up periodical list. The keys of this sort are title code, card number and correction code.

Routine 11 - Format and Sequence Check

Routine 11 is a format check of the sorted correction cards. The sequence is also checked. Format or sequence errors are typed out on line. At the same time the incorrect items are put out on an error output file. If there are no errors in the data, "NO ERRORS" will be printed.

Routine 12 - Update

Routine 12 is an update used to produce the current periodical file.

The inputs to this routine are the sorted, formatted correction cards and the periodical file. The routine matches the two files on title code and depending on correction code deletes, inserts or replaces the appropriate item. An on-line printout will indicate the error - a match found for an insert item, or no match found for a deletion item.

Routine 13 - Edit

Routine 13 is used to produce an edited listing of current periodicals in the master file. Each input record is edited to produce a line item of the "Master List of Periodical". In addition to editing, the total cost of the document is computed. Error conditions such as missing cards and the data out of sequence, are indicated by on-line typeouts. See Figure 8.

Routine 14 - Edit

Routine 14 produces the Periodical Status List, which is routed to the users, showing the periodicals and journals acquired by the library and their availability in the library for either reference or routing, or their availability in cognizant codes of the Bureau. See Figure 9.

Routine 15 - Edit

Routine 15 selects from the Periodical Master File all records which contain the expiration date specified by the "expiration date card" (input 2). The selected records are edited to produce the Order Reports for expiring domestic, foreign, and service periodicals. All of these reports are produced in this run by determining from the type code of the selected item, the type report to be produced. Type code contains a "D" for domestic, "F" for foreign, and "S" for service. Two basic computations are made for each order report: (a) amount = unit cost x quantity for each periodical, (b) total amount of an order report. Whenever the total amount for a

TITLE	R B Q	EN T	F D Y	TITLE	CODE	R T F	UNIT	TOTAL	PR	F	EXPIRES
CODE						Y Y Q	COST	COST	R	Y	M D
100 R 2 2				AIAA JOURNAL (AMER INST OF AERONAUTICS AND ASTRO)		L D M	30.00	60.00	8269	1 64	12 01
500				AIM (ASSIGNMENTS IN MANAGEMENT) LETTERS	269	M S	30.00	30.00	9237	1 64	04 01
1000				ARS JOURNAL (AMER ROCKET SOC) (SEE AIAA JOURNAL)							
2000				ASEA JOURNAL		L G M					
3000 R B 3				ASHRAE JOURNAL (AM SOC OF HEAT REFRIG AIR COND ENGRS)		L D M	4.60	13.60	9074	1 65	01 01
4000				ACCOUNTING AND DATA PROCESSING (SEE DATA PROCESSING)							
6000 R B 3				ACOUSTICAL SOCIETY OF AMERICA, JOURNAL		L D M	22.00	66.00	9074	1 65	01 01
7000 S 1				ACTA METALLURGICA		L D M	25.00	25.00	9074	1 65	01 01
8000 S 1				ACUSTICA		L F M	20.90	20.90	9086	1 65	01 01
9000 2 4				ADMINISTRATIVE MANAGEMENT		L D M	4.00	16.00	9074	1 65	01 01
10000 2 2				ADMINISTRATIVE SCIENCE QUARTERLY		L D Q	7.25	14.50	9074	1 65	01 01
11000				ADVANCED MANAGEMENT (SEE ADVANCED MAN-OFFICE EXEC)							
12000 R 2 7				ADVANCED MANAGEMENT		L D Q	7.40	51.80	9074	1 65	01 01
13000 2 1				AERIAL (MARCONI'S WIRELESS TELEGRAPH CO. LTD)		L G Q					
14000				AEROSPACE ENGINEERING (SEE ASTRONAUTICS AND AER ENG)							
15000 2 1				AEROSPACE MANAGEMENT							
16000 M 1				AGING	268	L D M	10.00	10.00	9183	1 65	03 01
17000 M 1				AGRICULTURE AND FOOD CHEMISTRY	634A	M D M	1.00	1.00		1 65	01 01
18000 1 1				AIR CONDITIONING, HEATING AND REFRIGERATION NEWS		L D M	20.00	20.00	9074	1 65	01 01
19000 R B 4				AIR CONDITIONING, HEATING AND VENTILATION		L D M	5.40	5.40	9074	1 65	01 01
19500				AIR-CUSHION VEHICLES		L D M	4.60	18.40	9074	1 65	01 01
20000				AIRCRAFT AND MISSILES (SEE AEROSPACE MANAGEMENT)		L F M	2.70	5.40	4056	1 65	01 01
20500 3				AIRCRAFT ENGINES OF THE WORLD		L S A	15.00	45.00		1 65	01 01
21000 M 1				AIRMAN'S GUIDE	690A	M D M	7.90	7.00		1 65	03 01
22000 M B 1				ALL HANDS		L G M					
24000 R 3 1				AMERICAN BOOK PUBLISHING RECORD		L G M	12.00	12.00	9254	1 64	06 01
25000 R B 1				AMERICAN BUREAU OF SHIPPING BULLETIN							
25025 3				AMERICAN BUREAU OF SHIPPING, RECORD		M S A	100.00	300.00	9263	1 64	04 01
25030 30				AMERICAN BUSINESS OF SHIPPING, RULES		L S A	10.00	300.00	9199	1 64	02 01
26000				AMERICAN BUSINESS (SEE ADMINISTRATIVE MANAGEMENT)							
27000 2 1				AMERICAN CERAMIC SOCIETY BULLETIN		L D M	6.00	6.00	9074	1 65	01 01
28000 2 1				AMERICAN CERAMIC SOCIETY JOURNAL		L D M	20.00	20.00	9074	1 65	01 01
29000 B 2				AMERICAN CHEMICAL SOCIETY JOURNAL		L D M	30.00	60.00	9074	1 65	01 01
29500 1				AMERICAN COUNCIL ON EDUC, FACTBOOK ON HIGHER EDUCATION		L S S	20.00	20.00	9226	1 65	01 01
30000 M 1 1				AMERICAN CROSBY CLIPPER		L G M					
31000 P B 1				AMERICAN DOCUMENTATION		L D Q	12.00	12.00	9074	1 65	01 01
33000				AMERICAN FOUNDRYMAN (SEE MODERN CASTING)							
34000 2 1				AMERICAN GEOPHYSICAL UNION TRANSACTIONS		L G Q					
35000 M 1				AMERICAN HOROLOGIST AND JEWELER	665J	L D M	3.00	3.00	9256	1 64	05 01
36000 2 2				AMERICAN JOURNAL OF PHYSICS		L D M	10.00	20.00	9074	1 65	01 01
37000				AMERICAN LUMBERMAN (SEE BUILDING MATERIALS MER)							
38000 R 2 2				AMERICAN MACHINIST		L D M	3.00	6.00	9074	1 65	01 01

Figure 8. Sample Master List of Periodicals

PERIODICALS RECEIVED BY THE TECHNICAL LIBRARY

1 JANUARY 1964

PAGE 101

REF AVAILABLE IN THE LIBRARY - NOT ROUTED
N RECEIVED IRREGULARLY - NOT ROUTED
* RETAINED IN CODE INDICATED

CHECK IN PARENTHESIS
IF ROUTING IS REQUIRED

()	AIAA JOURNAL (AMER INST OF AERONAUTICS AND ASTRO)	
()	ARS JOURNAL (AMER ROCKET SOC) (SEE AIAA JOURNAL)	
()	ASEA JOURNAL	
()	ASHRAE JOURNAL (AM SOC OF HEAT REFRIG AIR COND ENGRS)	
()	ACCOUNTING AND DATA PROCESSING (SEE DATA PROCESSING)	
()	ACCOUNTING REVIEW	
()	ACOUSTICAL SOCIETY OF AMERICA, JOURNAL	
()	ACTA METALLURGICA	
()	ACUSTICA	
()	ADMINISTRATIVE MANAGEMENT	
()	ADMINISTRATIVE SCIENCE QUARTERLY	
()	ADVANCED MANAGEMENT (SEE ADVANCED MAN-OFFICE EXEC)	
()	ADVANCED MANAGEMENT	
()	AERIAL (MARCONI'S WIRELESS TELEGRAPH CO. LTD)	
()	AEROSPACE ENGINEERING (SEE ASTRONAUTICS AND AER ENG)	
()	AEROSPACE MANAGEMENT	
	*AGING	269
	*AGRICULTURE AND FOOD CHEMISTRY	634A
()	AIR CONDITIONING, HEATING AND REFRIGERATION NEWS	
()	AIR CONDITIONING, HEATING AND VENTILATION	
()	AIR-CUSHION VEHICLES	
	AIRCRAFT AND MISSILES (SEE AEROSPACE MANAGEMENT)	
	*AIRMANS GUIDE	69CA
REF	ALL HANDS	
REF	AMERICAN BOOK PUBLISHING RECORD	
REF	AMERICAN BUREAU OF SHIPPING BULLETIN	
	AMERICAN BUSINESS (SEE ADMINISTRATIVE MANAGEMENT)	
()	AMERICAN CERAMIC SOCIETY BULLETIN	
()	AMERICAN CERAMIC SOCIETY JOURNAL	
()	AMERICAN CHEMICAL SOCIETY JOURNAL	
()	AMERICAN CROSBY CLIPPER	
REF	AMERICAN DOCUMENTATION	
	AMERICAN FOUNDRYMAN (SEE MODERN CASTING)	
()	AMERICAN GEOPHYSICAL UNION TRANSACTIONS	
	*AMERICAN HOROLOGIST AND JEWELER	665J
()	AMERICAN JOURNAL OF PHYSICS	
	AMERICAN LUMBERMAN (SEE BUILDING MATERIALS MER)	
()	AMERICAN MACHINIST	
()	AMERICAN MATHEMATICAL MONTHLY	
()	AMERICAN MATHEMATICAL SOCIETY, BULLETIN	
()	AMERICAN MATHEMATICAL SOCIETY, TRANSACTIONS	
()	AMERICAN METAL MARKET	
()	AMERICAN OIL CHEMISTS SOCIETY JOURNAL	
()	AMERICAN PAINT JOURNAL	
()	AMERICAN PHYSICAL SOCIETY, BULLETIN	
	AMERICAN PRINTER (SEE INLAND PRINTER-AM LITHOG)	

Figure 9. Sample Periodical Status List

particular type periodical exceeds the funding level, the total amount is printed on the bottom of the current page and a new page of the Order Report is started with the next input item. See Figures 10a, 10b and 10c.

In addition to the editing, the master file is updated when the expiration data matches the item on the file. A new expiration date is computed as follows:

Year of expiration date on master file plus renewal frequency equals updated year of expiration date. This new date is inserted in the Master File. If there is no match, the item is put out on the new master file without modification.

Subject Matter File Maintenance

The Subject Matter Master File is maintained by three basic routines plus an edit which is used as a worksheet. This system is composed of Routines 16 thru 19.

Routine 16 - Sort

This IBM 7090 generated sort sequences input data for updating the Subject Matter File on the following keys: classification, accession number link, card number, and subcard number.

Routine 17 - Format

Routine 17 is a format check of all significant data fields of the correction items before the master file is updated. In addition to data verification, this routine also groups the subject matter data by links. The output record contains all data for a given link. Some of the fields checked are classification, accession number, and linkage. If the input file contains more than 30 items (the limit) with the same link, classification, and accession number, the data is rejected and

an on-line message is printed out to that effect. Also each input item is rearranged according to the output format.

Routine 18 - Update

Routine 18 is used to keep the Subject Matter Master File current. Obsolete items are deleted and new items are added. All corrections are made by linkage (security classification, accession number and link). This means that in order to correct an error in any given link, the entire link must be deleted by the use of one correction card containing a zero in the correction code field. Error conditions occur when there are no matching cards on the master file for a deletion item or when there is a match for an insertion card. The error items are put on tape and a message to that effect is printed out.

Routine 19 - Edit

This routine edits the Subject Matter Master File. There are two inputs to this routine, the Subject Matter Master File and a card containing the date. This card must be inserted behind the binary deck. See Figure 11.

Bibliographic And Subject Matter Searches

Five routines are needed to accomplish the Bibliographic and Subject Matter searches. These are Routines 21 thru 25.

Routine 21 - Search

Routine 21 is the Bibliographic Search routine for the retrieval system. The two inputs to this routine are the Bibliographic Master File and the query cards. These cards are matched against the file until a "hit" occurs. When this happens, the accession number from the Bibliographic Master File and query and part number from the query cards are written on tape and at the same time printed on-line.

DOMESTIC SUBSCRIPTION RENEWAL FOR BUREAU OF SHIPS TECHNICAL LIBRARY				
ITEM NUMBER	TITLE	QTY	UNIT PRICE	AMOUNT
	U.S. NAVAL INSTITUTE PROCEEDINGS	7	6.00	42.00
	U.S. NEWS AND WORLD REPORT	4	5.50	22.00
	WASHINGTON SCIENCE TRENDS	1	40.00	40.00
	WELDING ENGINEER	1	2.85	2.85
	WELDING JOURNAL	3	7.70	23.10
	WIRE AND RADIO COMMUNICATIONS	1	1.80	1.80
	WIRE AND WIRE PRODUCTS	1	7.25	7.25
	WORLD POW'S AND THE MARINER	1	3.80	3.80
	YACHTING	5	5.40	27.00
TOTAL AMOUNT				169.80

Figure 10a. Sample Domestic Subscription Renewal Form

FOREIGN SUBSCRIPTION RENEWAL FOR BUREAU OF SHIPS TECHNICAL LIBRARY				
ITEM NUMBER	TITLE	QTY	UNIT PRICE	AMOUNT
	EUROPEAN SHIPBUILDING	4	9.00	36.00
	FIRE	1	4.50	4.50
	FOUNDRY TRADE JOURNAL	1	12.50	12.50
	HOROLOGICAL JOURNAL	1	3.50	3.50
	HOVERING CRAFT AND HYDROFOIL	2	10.00	20.00
	ILLUSTRATED LONDON NEWS	2	21.00	42.00
	INDUSTRIAL ELECTRONICS	2	8.50	17.00
	INSTITUTE OF FUEL JOURNAL	1	21.00	21.00
	INSTITUTE OF MARINE ENGINEERS, TRANSACTIONS	4	22.00	88.00
	INSTITUTE OF NAVIGATION, JOURNAL	2	7.00	14.00
	INSTITUTION OF ELECTRICAL ENGINEERS, JOURNAL	3	14.00	42.00
	INSTITUTION OF ELECTRICAL ENGINEERS, PROCEEDINGS	4	28.00	112.00
	INTERNATIONAL SHIPBUILDING PROGRESS	4	14.00	56.00
TOTAL AMOUNT				468.50

Figure 10b. Sample Foreign Subscription Renewal Form

SERVICE SUBSCRIPTION RENEWAL FOR BUREAU OF SHIPS TECHNICAL LIBRARY					
ITEM NUMBER	TITLE		QTY	UNIT PRICE	AMOUNT
	COMMERCE CLEARING HOUSE. CONTRACT APPEALS DECISIONS	150	1	70.00	70.00
	COMMERCE CLEARING HOUSE. CONTRACT APPEALS DECISIONS	152	1	70.00	70.00
	COMMERCE CLEARING HOUSE. GOVERNMENT CONTRACTS REPTS	150	1	150.00	150.00
	COMMERCE CLEARING HOUSE. GOVERNMENT CONTRACTS REPTS	152	1	150.00	150.00
TOTAL AMOUNT					440.00

Figure 10c. Sample Service Subscription Renewal Form.

SHARP SUBJECT MATTER INDEX

SEC CLAS	ACCESS NUMBER	LINK	ROLE 8	ROLE 1	ROLE 2	ROLE 3	ROLE 4	ROLE 5	ROLE 6	ROLL 7	ROLE 9	ROLE 10
U	061718	A	VALVES				PROPULS STEAMTR GASTURB TURBINE					
B			GASTURB TURBINE				PROPULS STEAMTR TURBINE GASTURB					
C			TACHMTR METLRS REDGEAR GEARS				REDGEAR GEARS PROPULS STEAMTR TURBINE GASTURB					
D			BEARING SOLENOID COILS VALVES				CLUTCHS STEAMTR TURBINE GASTURB PROPULS					
E			TESTS				CLUTCHS PROPULS STEAMTR TURBINE GASTURB				CLUTCHS BRAKES DESIGN	
F			METERS				CONTRSY PROPULS STEAMTR TURBINE GASTURB					

Figure 11. Sample Subject Matter Master File Edit

QUERY NO. 0201

LIBRARY
NUMBER

NEW YORK NAVAL SHIPYARD. MATERIAL LAB.

U069553

PROJ. 4433-123.

ELECTRIC STORAGE BATTERY CO.

EVALUATION OF SUBMARINE MAIN STORAGE BATTERY CELLS
EXIDE TYPE MAX-93B SUPPLIED TO USS ALBACORE UNDER
CONTRACT NOBS-55079 WITH THE ELECTRIC STORAGE BATTERY
COMPANY, PHILADELPHIA, PENNSYLVANIA (U). FINAL REPT.

CNOBS 55079 06/21/57

001V AD 141262L R

NEW YORK NAVAL SHIPYARD. MATERIAL LAB.

U069903

PROJ. 4433-120.

ELECTRIC STORAGE BATTERY CO.

SUBMARINE MAIN STORAGE BATTERY CELLS EXIDE TYPE MLB-
49 MANUFACTURED BY ELECTRIC STORAGE BATTERY COMPANY
PHILADELPHIA, PENNSYLVANIA (U). FINAL QUALIFICATION
TEST REPT.

06/21/57

001V AD 141263L R

NEW YORK NAVAL SHIPYARD. MATERIAL LAB.

U103325

PROJ. NO. 4433-115.

ELECTRIC STORAGE BATTERY CO.

SUBMARINE STORAGE BATTERY CELLS EXIDE TYPE MAW-67C
FROM CONTRACT NOBS 53584 WITH ELECTRIC STORAGE
BATTERY COMPANY. (U). FINAL TECHNICAL EVALUATION REPT.

CNOBS 53584 11/07/56

001V AD 118549L M

Figure 12. Sample Query Results Edit.

Routine 22 - Select

Routine 22 selects the document from the Bibliographic Master File that corresponds to the accession number selected during the search routine. The query and part numbers are inserted into each item for sorting purposes. This routine keeps track of each query and part number for which a document has been selected, so that no document can be selected more than once for the same query and part.

Routine 23 - Sort

Routine 23 is an IBM 7090 generated sort. The keys sequenced by this sort are query, part number, security classification and accession number.

Routine 24 - Edit

Routine 24 edits the bibliographic data from the search results. The title and date are printed on the first page only. The query and part number are printed on each page. When the security classification is "C" or "S" the words "CONFIDENTIAL" or "SECRET" are put in the heading. Slashes are inserted in publication and covering date. See Figure 12.

Routine 25 - Search

Routine 25 is the Subject Matter search routine and is an adaptation of the Bibliographic search routine. The searching performed by this routine is based upon the Engineers Joint Council (EJC) System of Roles and Links. The procedure for searching is identical to that for Routine 21.

CURRENT PROGRESS AND FUTURE PLANS

Under Contract NObs 88417, Herner and Company, Washington, D.C., evaluated the subject matter search

aspects of the Project SHARP System. In their report, Reference (10), they concluded (1) that the adaptation of the EJC indexing scheme of links and roles is feasible and (2) that, "... the System has high discriminating power, capable of retrieving a small subset of high-relevance documents with very little noise." They recommend, also, improvement in coding procedures, attention to the depth of indexing, and optimum application of role indicators.

The evidence and experience gained leave little room to doubt the feasibility, desirability and usefulness of the SHARP System as a tool for better library service and management. Thus, many new features have been added to the library's ability to serve.

In the design and development of the System, however, certain desirable features were planned for, but could not be accomplished until prior parts of the System had been evaluated. Some of features are essentially an extension or an improvement of existing features and coincidentally, incorporate recommendations of the contractor.

Planned Extensions in Progress:

1. Computerized Thesaurus. The Bureau of Ships Technical Library's operations will never be sufficiently automated until the Thesaurus becomes a file suitable for computer processing. Such a file is necessary for a. complete automatic generic computer searches, b. automatic posting of descriptive terms by the computer in the indexing process, c. verification and checking of coding and indexing, and d. updating, editing and publishing the Thesaurus. In addition, with a computerized Thesaurus considerable manual checking can be eliminated in the process of maintaining indexed files. Such an improvement will guarantee "perfect"

data files.

2. Automatic Generic Searching. This feature is dependent on, and is being developed concurrently with the foregoing. With the Thesaurus computerized, automatic generic searching is possible. On command, the computer can do an efficient job of selecting related, narrow and/or broader terms to be included in searches. The computer can also perform the corresponding function of generic indexing.
3. User Interest Register. Better automatic service to the scientist and engineer will be accomplished in the employment of a common media between the User and the SHARP System. Such a common media would be the descriptor terms applied to the User, i.e., a file of indexed User's subject interests or requirements. He would then be advised, or have routed to him, only relevant technical documents in his indicated subject requirements. Such a file must include also the biographic data (name, code, telephone, room number, etc.) of the User. This feature is presently in the testing stage.

Planned Improvements:

In the developmental application of the System, and in the evaluation and testing phase, it became evident that some minor modifications and improvements were highly desirable. These include the following:

1. Control over the optional use of roles during subject searches is presently handled through the query cards. It would be considerably more efficient to maintain this control in the

search routine itself.

2. Bureau librarians require additional fields to be included in the bibliographic search. Some of these are:
 - a. Report Title Security Classification.
 - b. Group number for Automatic Phase Downgrading (applicable to classified documents only).
 - c. Additional Contract Numbers.
3. Use of the expanded Cutter Table of author numbers as the search media for authors in lieu of authors names.
4. Modification of formats of edits particularly of the bibliographic data printout of the Accessions Bulletin.
5. Fields for additional subject headings, and for the number of references included at the end of some reports.
6. Redefine Role functions to conform more harmoniously with the Bureau's subject matter and areas of interest.
7. Other improvements in the areas of the coordinated search and the structure of the files.

In addition to the foregoing, other features contemplated for incorporation into the System are outlined in Reference (4). These will also include journal and periodical holdings as part of the Technical Library's automated control system of these publications. Finally, the inclusion of selected journal and periodical articles in the body of the literature to be indexed is contemplated. The retrieval of this type of information

presents no problem since the search routines are as applicable to

this material as they are to scientific and technical reports.

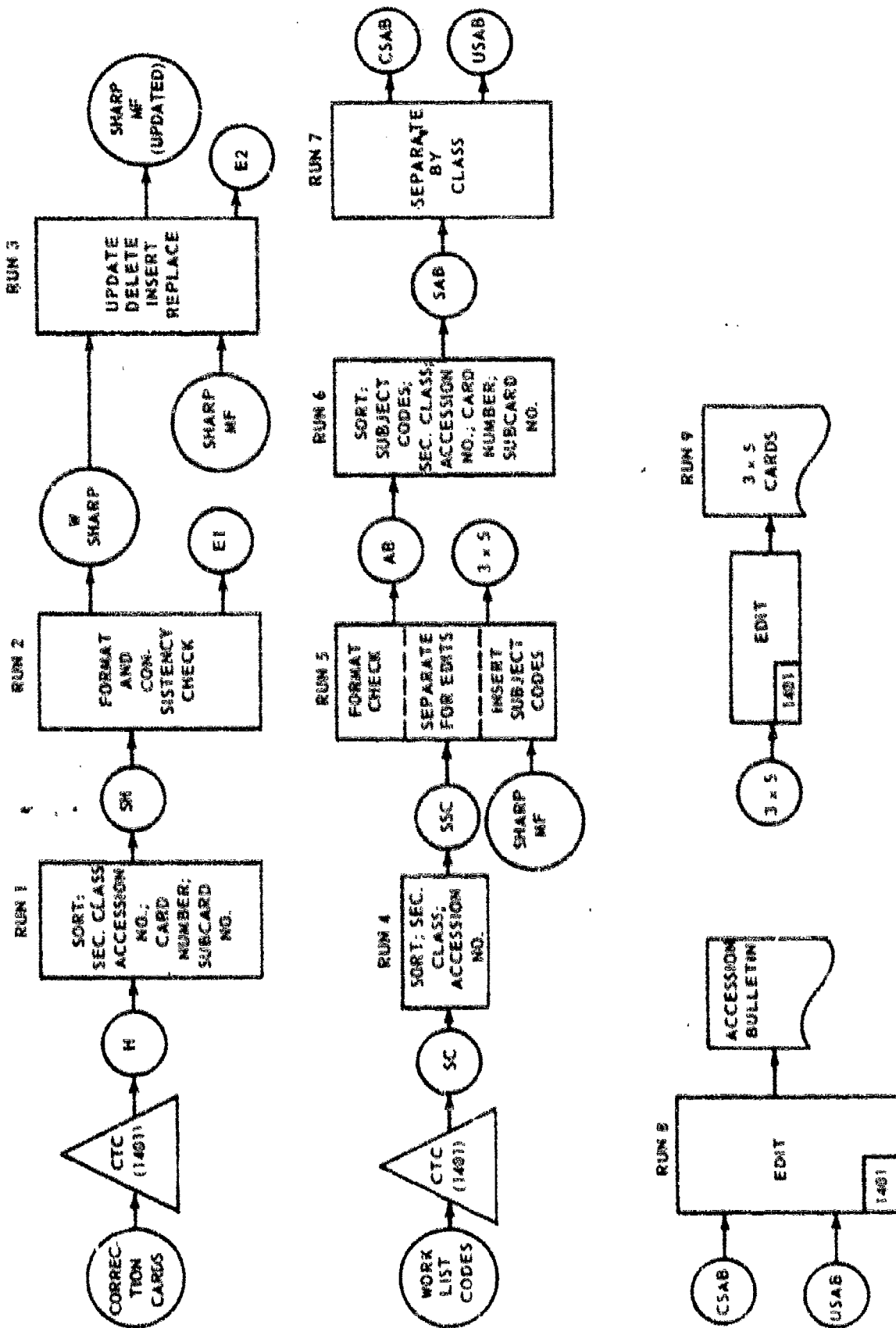
REFERENCES

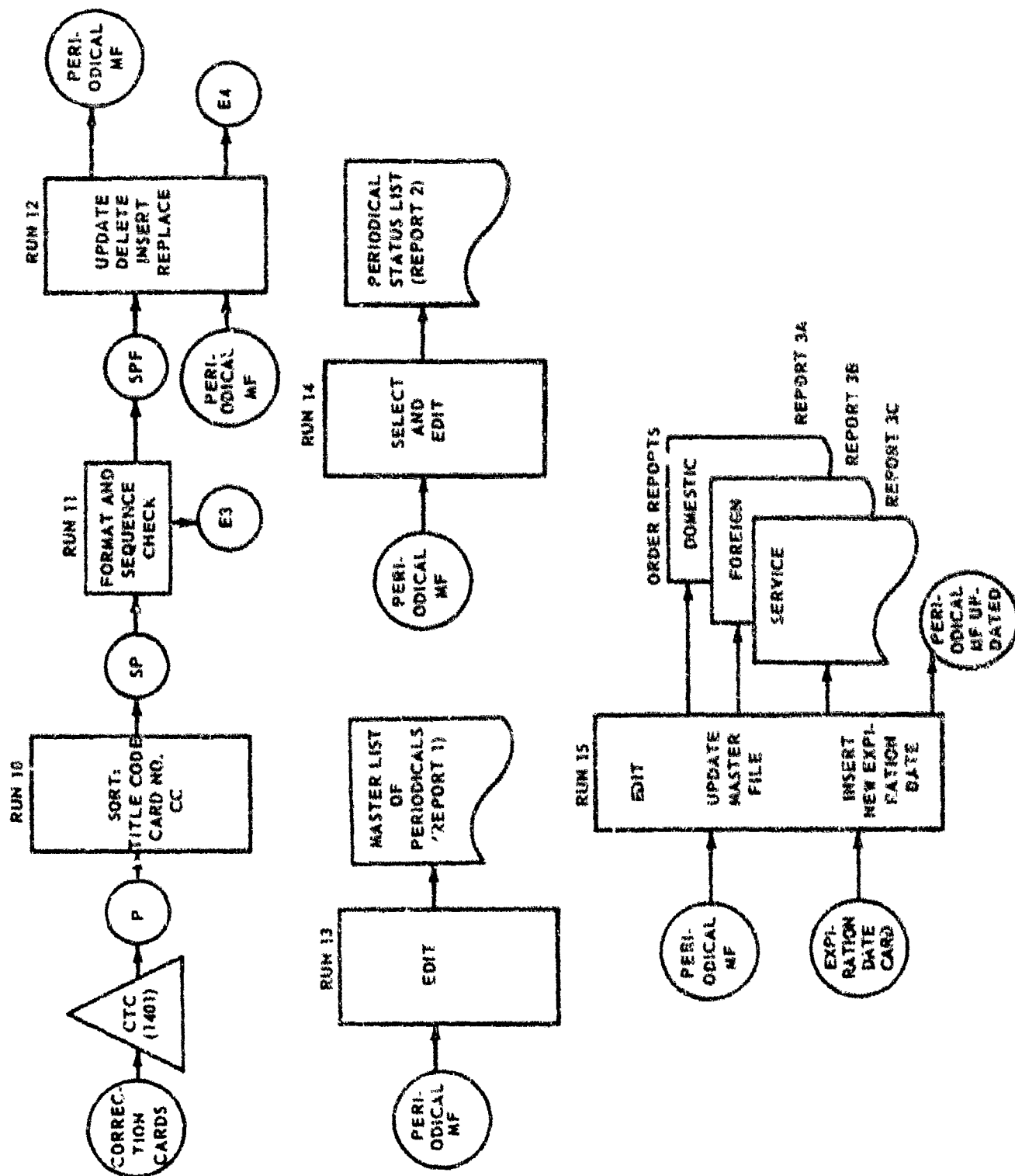
- (1) Armed Services Technical Information Agency, Thesaurus of ASTIA Descriptors, second edition, Arlington, Va., 1962.
- (2) Bureau of Ships, Technical Information Branch (Technical Library), Project SHARP (SHips Analysis and Retrieval Project) Specifications, March 1961.
- (3) Camp, Ruth D., Bureau of Ships Technical Library, Thesaurus of Descriptive Terms and Code Book, Department of the Navy, Washington, D. C., December 1963, first edition, (NAVSHIPS 250-210-1).
- (4) Nicolaus, John J., The Automated Approach to Technical Information Retrieval - Library Applications, Department of the Navy, Bureau of Ships, Washington, D. C., March 1964, (NAVSHIPS 250-210-2). (Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.)
- (5) Costello, John C. Jr., "Indexing in Depth: Practical Parameters" in Information Handling: First Principles, Washington, D. C., Spartan Books, 1963, pp. 55-87.
- (6) Costello, John C. Jr., Training Manual and Workbook for Use in Abstracting and Coordinate Indexing Training Course, Battelle Memorial Institute, Columbus, Ohio, 1963.
- (7) David Taylor Model Basin, Applied Mathematics Laboratory, Report No. 154, Ships Analysis and Retrieval Project SHARP Interim Report, by Percy C. Tomlinson, May 1962.
- (8) David Taylor Model Basin, Applied Mathematics Laboratory, Report No. 144, Automatic Development of BUSHIPS Technical Library Bulletins, by Natalie R. Tartar, November 1961.
- (9) David Taylor Model Basin, Applied Mathematics Laboratory, Report No. 160, Automatic 3x5 Catalog Cards for BUSHIPS Technical Library, by Natalie R. Tartar, June 1962.
- (10) Project SHARP (SHips Analysis and Retrieval Project) Information Storage and Retrieval System: Evaluation of Indexing Procedures and Retrieval Effectiveness, prepared by Walter F. Johanningsmeir and Wilfred F. Lancaster, Herner and Co., Wash., D. C. for Department of the Navy, Bureau of Ships, Washington, D. C., June 1964, (NAVSHIPS 250-210-3). (Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.
- (11) IBM 7090 Data Processing System, Reference Manual, A22-6528-4, February, 1963.

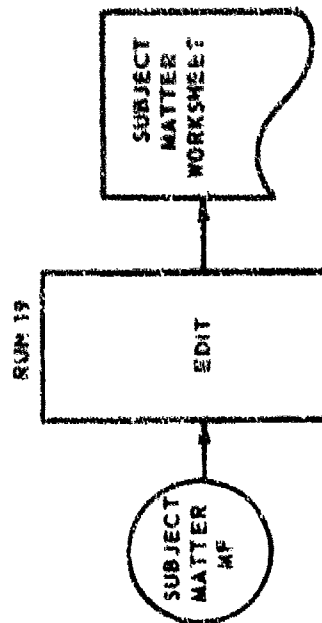
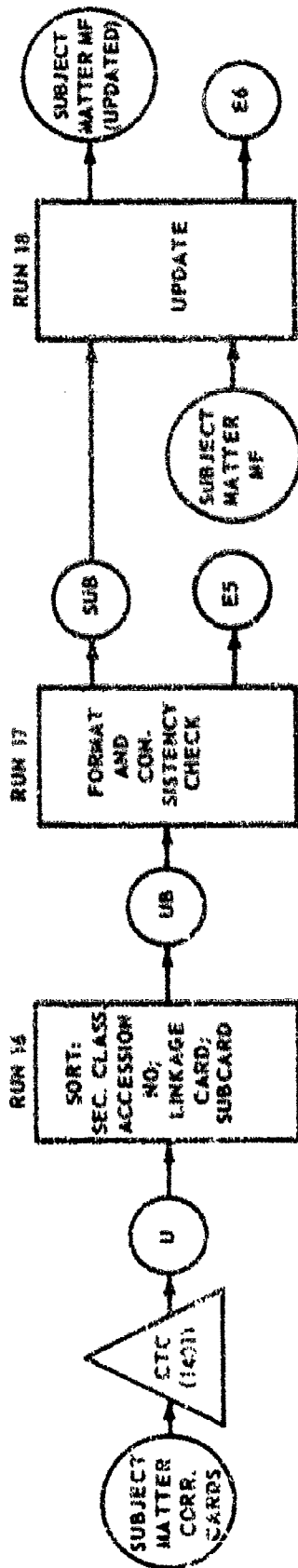
- (12) IBM 709/7090 Input/Output Control System, Reference Manual, C28-6100-1, February 1961.
- (13) IBM 1401 Data Processing System, Reference Manual, A24-1403-5, April 1962.
- (14) Defense Documentation Center, DDC Identifier Thesaurus Code Manual, Arlington, Va. August 1963.

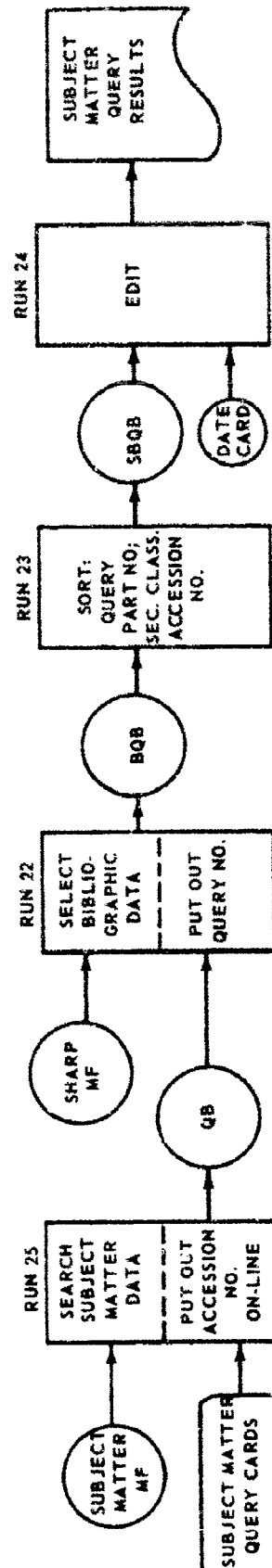
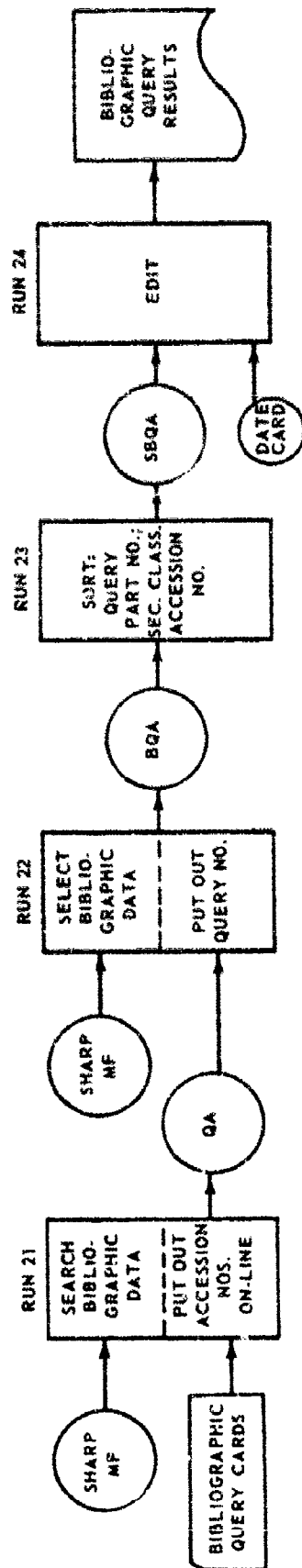
APPENDIX A

Flow Diagrams of the SHARP System









**— APPENDIX —
B**

THE ENGINEERS JOINT COUNCIL

SYSTEM OF ROLES

**AS ADAPTED FOR USE BY THE BUREAU
OF SHIPS TECHNICAL LIBRARY**

- **MEANINGS**
- **EXAMPLES**
- **EXPLANATIONS**
- **EXCLUSIONS**

MEANINGS

The primary topic of consideration is
 The principal subject of discussion is
 The subject reported is
 The major topic under discussion is
 There is a description of

EXAMPLES

In each example, replace the "8" with one of the meanings listed above

8-Adhesives	8-Ionization
8-Alloying	8-Joining
8-Analysis	8-Lamination
8-Audiofrequency	8-Lining
8-Calculation	8-Maintenance
8-Coating	8-Manufacture
8-Comparison	8-Marketing
8-Composition	8-Measurement
8-Compression	8-Microanalysis
8-Concentration	8-Microstructure
8-Control	8-Molding
8-Conversion	8-Packaging
8-Corrosion	8-Permeability
8-Curricula	8-Polishing
8-Demineralizing	8-Polymerization
8-Design	8-Protection
8-Development	8-Proton Scattering
8-Dilution	8-Purification
8-Distillation	8-Removal
8-Dosimetry	8-Repair
8-Ductility	8-Research
8-Electrodialysis	8-Sales
8-End-Uses	8-Segregation
8-Evaporation	8-Separation
8-Extraction	8-Shaping
8-Fabrication	8-Simulation
8-Generation	8-Standards
8-Grinding	8-Surveying
8-Hysteresis	8-Testing
8-Identification	8-Theories
8-Inclusion	8-Transferring
8-Installation	8-Transporting
8-Interferometers	8-Vaporization

EXPLANATIONS

The term indexed in Role 8 represents the concept of primary importance in an intellectual relationship of ideas in a document. If there are a number of such intellectual relationships, there may be a number of terms in Role 8. When Role 8 is used on a number of terms to describe the intellectual relationships in a document, indexers must be certain that they determine if all of them can be used in one link or whether two or more links must be used to prevent false retrieval. Once the indexer has determined what term or terms should properly be assigned Role 8, selecting other terms and their proper roles will follow logically. The term(s) in Role 8 is the key idea in an indicative abstract statement of document content.

Role 8 will be used on terms for materials, mixtures, or substances only when the term identifying the material, mixture, or substance is used in conjunction with a "class of use" term, that is, a term identifying the class of use to which the material is to be put. For example, let us assume that Mytare is a material, and the class of use to which it is put is as an adhesive. Then 8-ADHESIVES with 8-MYTARE is correct and means "a primary topic of consideration is the adhesive Mytare."

EXCLUSIONS

In cause-effect relationships, the "cause" or "independent variable" concept should be indexed in Role 6, the "effect" or "dependent variable" concept should be indexed in Role 7. To use Role 8-EFFECT with a Role 6-Role 7 pair of terms is unnecessary, since a term in Role 6 and a term in Role 7 have in them the inherent implication of 8-EFFECT. The Role 6-Role 7, or cause-effect pair of roles, is the only type of link in which no term is indexed in Role 8.

ROLE 1

MEANINGS

Input
Raw Material
Material of construction
Reactant
Base metal (for alloys)
Components to be combined
Constituents to be combined
Ingredients to be combined
Material to be shaped
Material to be formed
Ore to be refined
Sub-assemblies to be assembled
Energy input (only in an energy conversion)
Data and types of data (only when inputs
to mathematical processings)
A material being corroded

EXAMPLES

Base metal in alloying
1-COPPER
Energy conversion input
1-HEAT
Components to form a mixture
1-AMMONIUM SULFATE
1-SODIUM NITRATE
1-TRICALCIUM PHOSPHATE
Material to be refined
1-ILMENITE ORE
Material to be shaped or formed
1-POLYETHYLENE
1-BRASS
Reactants in a chemical reaction
1-SODIUM HYDROXIDE
1-HYDROCHLORIC ACID
Inputs to nuclear reactions
Input data to mathematical operations
Components to be assembled into apparatus
or equipment

EXPLANATIONS

Role 1 is used on terms for materials, devices, apparatus, and equipment which are subjected to processes or operations which modify or change the original identity, composition, configuration, molecular structure, physical state, or physical form of the materials. To be indexed in Role 1, one or more of these characteristics or properties must be changed.

Role 1 is used on a form of energy when the purpose of the operation or system is to change the form of energy.

Role 1 is used on terms for data and data quantities which are inputs to mathematical operations and systems.

EXCLUSIONS

When a form of energy might be considered as an "input", but its purpose is only to serve "as a means of accomplishment" of the primary topic of consideration, or to effect an operation or process, and the purpose is not to change the form of energy, index the form of energy in Role 10, as 10-HEAT, "using heat".

If an operation or process is performed on materials or devices, and they have the same identity, composition, configuration, molecular structure, physical state, or physical form after the process or operation as they did before, index them in Role 9.

ROLE 2

MEANINGS

Output
Product, by-product, co-product
Object or building constructed
Intermediate product
Alloy produced

EXPLANATIONS

Role 2 is used on terms for materials, alloys, mixtures, devices, equipment, apparatus produced in a process, operation, or system in which materials in Role 1 have had one or more of the following

ROLE 2 (Continued)

MEANINGS (ctd.)

Resulting material
 Resulting mixture or formulation
 Material manufactured
 Mixture manufactured
 Device shaped or formed
 Metal or substance refined
 Device { made, assembled
 Equipment { built, fabricated
 Apparatus { constructed, created
 Energy output (only in an energy conversion)
 Data and types of data (only as mathematical processing outputs)

EXPLANATIONS (ctd.)

changed or modified; original identity, composition, configuration, molecular, structure, physical state, or physical form.

Use Role 2 on data and data quantities derived in a mathematical process or operation from input data indexed in Role 1.

Use Role 2 on a form of energy to which a form of energy in Role 1 has been converted.

EXAMPLES

Alloy produced
 2-BRASS
 Energy conversion output
 2-LIGHT
 Mixture formulated or produced
 2-MIXED FERTILIZERS
 Refined material obtained
 2-TITANIUM
 Form or shape produced
 2-BOTTLES
 2-TUBING
 Products formed in chemical reactions
 2-SODIUM CHLORIDE
 2-WATER
 Products of nuclear reactions
 Data produced in mathematical operations
 The assembled device

EXCLUSIONS

If a material, device, piece of equipment, mixture, or abstract concept such as a property, characteristic, condition, or quality, is subjected to an operation, process, or system, and its identity, composition, configuration, molecular structure, physical state, or physical form is the same before and after the operation, process, or system, it is not a "1-input 2-output" relationship. The material, device, equipment, mixture, or abstract concept should be indexed in Role 9.

The output of an operation, process, or system is always indexed in Role 2 unless the intent or content of the document unquestionably indicates that it is undesirable, unnecessary, or harmful, in which case that output is indexed in Role 3.

ROLE 3

MEANINGS

Undesirable component
 Waste
 Scrap
 Rejects (manufactured devices)
 Contaminant { -in inputs
 Impurity { -in outputs
 Pollutant { -in environments
 Adulterant { -in materials passively receiving
 Poison { actions

EXPLANATIONS

The content or the intent of the information must indicate that a material is undesirable or unnecessary to justify indexing it in Role 3. In a combination of inputs (Role 1 concepts), outputs (Role 2 concepts), environments (Role 5 concepts), or passive recipients of processes or operations (Role 9 concepts), Role 3 may be used on a term for a material but only if it is clearly identified as undesirable or unnecessary.

ROLE 3 (Continued)

MEANINGS (ctd.)

Undesirable material present
Unnecessary material present
Undesirable product, by-product,
co-product

EXAMPLES

An undesirable component in an input material

1-WATER
3-ALGAE

An undesirable component in an output material

2-VANADIUM CHLORIDES
3-BENZOYL CHLORIDE

An undesirable component in a solvent or medium

5-AIR
3-HYDROGEN SULFIDE

An undesirable component in a material passively receiving an operation

9-OIL
3-WATER

Substandard or unacceptable manufactured devices

3-PYROMETERS

EXPLANATIONS (ctd.)

Role 3 is used on devices, equipment, or apparatus if they are characterized as rejects, substandard, unacceptable or not useable.

EXCLUSIONS

If the primary topic of consideration is a type of separation, such as 8-CENTRIFUGATION, and the materials being separated are either both desirable or are not indicated or implied to be undesirable, use Role 2 on the materials resulting from the separation (1-MILK, 2-CREAM, 2-SKIM MILK). However, if the primary topic of consideration has the implication of purifying, such as 8-REMOVAL or 8-PURIFICATION, then use Role 1 on the material being purified and Role 3 on the undesirable material being removed.

ROLE 4

MEANINGS

Indicated, possible, intended present or later uses or applications.

The use or application to which the term has been, is now, or will later be put.

To be used as, in, on, for, or with

For use as, in, on, for, or with

Used as, in, on, for, or with

For later use as, in, on, for, or with

EXPLANATIONS

Role 4 is to be used with terms which discuss the indicated, intended, or possible present or later uses to which a material, mixture, device, etc., discussed in a link can be or is put. Role 4 is used primarily when a material, mixture, device, etc., is being manufactured, produced, or fabricated, and the content or intent of the information points out how or in what situation or manner it can be or is subsequently used.

ROLE 4 (Continued)

EXAMPLES

In each example, replace the "4" with either "for", "for later use on", "for later use as", "for later use in", "to be used for", "to be used as", "to be used in", "used in", "used as", "used for".

4-CONTAINERS
4-DEMOLITION
4-DRIVE SHAFTS
4-FABRICATION
4-INHIBITORS
4-INSECTICIDES
4-LUNAR PROBES
4-RADOMES
4-SPACE VEHICLES
4-TELEMETRY
4-TRANSISTORS

ROLE 5

MEANINGS	EXPLANATIONS
Environment	Included in Role 5 are modifiers (adjectives and adverbs), and those geographical locations not included as part of the bibliographic data in Role 0. Also, terms in Role 5 represent materials present in or introduced into an operation, process, or other material, for the purpose of facilitating completion of the operation or process or to improve the qualities, conditions, or characteristics of the other material. 5-FREON 22 may be the carrier gas in which a sprayed liquid is carried. If it <u>also</u> is the propellant, it <u>also</u> will be indexed as 10-FREON 22 and 10-PROPELLANTS. 5-WATER may be means for conveying coal in a slurry. 5-ARGON or 5-NITROGEN may be blanketing, scrubbing, or purging gases.
Medium	
Atmosphere	
Solvent	
Carrier (material)	
Support (in a process or operation)	
Vehicle (material)	
Permeating gas	
Permeating liquid	
Host	
Adsorbent	Materials in Role 5 describe the gas, liquid, or solid in which or on which other materials are processed or operated. Role 5 materials may be present with input materials but are not themselves inputs in the sense of Role 1. In this sense they are "inert" or "neutral".

ROLE 5 (Continued)

MEANINGS (ctd.)

Absorbent

EXAMPLES

Replace the "5" in the following examples with the meaning preceding it:

"in _____ as a solvent"

5-WATER

5-BENZENE

"in an atmosphere of _____"

5-NITROGEN

5-HELIUM

"on a _____ support"

5-CHARCOAL

"in a _____ medium"

5-METHANOL

5-TURPENTINE

"in _____ as a carrier gas"

5-STEAM

5-CARBON DIOXIDE

EXPLANATIONS (ctd.)

To describe an operation or process taking place in a solid, liquid, or gas in a piece of equipment, index the solid, liquid, or gas in Role 5 and the piece of equipment in Role 10.

EXCLUSIONS

When a material is used as an active or primary means of accomplishing the operation or process which is the primary topic of consideration, or as a means for accomplishing any other objective, index it in Role 10. Materials in Role 5 assist in or facilitate the accomplishment but are not the primary means. Role 5 is used only with materials. These materials serve to support, surround, transport, blanket, carry, convey. Role 5 materials are materials "in which" or "on which" something happens or is done, not "to which" or "by which".

Any material which is changed in a process or operation cannot be indexed in Role 5. Role 5 materials are "inert" with respect to the operation or process. 10-FURNACE (meaning "in furnaces" or "using furnaces") is correct to describe the apparatus or equipment in which an operation or process takes place; equipment and apparatus are never indexed in Role 5. "In a vacuum" is indexed 10-VACUUM, not 5-VACUUM, since "in a vacuum" means "using no pressure". Hence, "in a vacuum" is the same as "using a vacuum".

ROLE 6

MEANINGS

Cause

Independent variable

Influencing factor

Controlled variable

EXPLANATIONS

Role 6 is used primarily on terms which represent properties, conditions, qualities, and characteristics. It may be used on terms for processes, operations, and systems to indicate how using or not using a process, operation, or system affects something in Role 7. Role 6 is used

CONT.

ROLE 6 (Continued)

MEANINGS (ctd.)

"X" as a factor affecting or influencing
"Y"

The "X" in "Y" is a function of X".

EXAMPLES

In each example, replace the "6" with "A"
primary topic of consideration is the ef-
fect of"

6-ELECTRON STRUCTURE

6-EMBRITTLEMENT

6-FAST NEUTRONS

6-FATIGUE

6-IMPURITIES

6-MICROCRACKING

6-PHOSPHOROUS

6-SLIDING VELOCITY

6-STRAIN RATE

6-STRESS

6-TEMPERATURE

6-THERMAL STRESS

6-TORSION

6-VISCOSITY

EXPLANATIONS (ctd.)

on materials and mixtures, only to indi-
cate that the presence or absence of the
material is the variable, or that using it
or not using it is the variable. Role 6 is
used on a "class of use" term, such as
adhesives, to show either that the vari-
able is using or not using them or that a
number of specific materials were eval-
uated as the variable.

Role 6 may be used on terms such as per-
formance, reliability, and dependability,
as qualities of equipment, devices, and
apparatus.

When two variables alternately or simul-
taneously affect each other, index both in
Role 6 and in Role 7.

If there are one or more terms indexed in
Role 6 in a link, there must also be one
or more terms indexed in Role 7 in the
same link.

EXCLUSIONS

Devices, equipment, and apparatus are not
indexed in Role 6. The operations or pro-
cesses they perform may be indexed in
Role 6 but primarily to indicate, as a var-
iable, whether or not the process or op-
eration was used. While 6 - GRINDING
would indicate how grinding a material or
not grinding it affects the material, 6-
RATE or 6-TEMPERATURE would des-
cribe the effects of varied conditions of
grinding.

ROLE 7

MEANINGS

Effect

Dependent variable

Influenced factor

EXPLANATIONS

Role 7 is used almost exclusively on terms
representing concepts such as charac-
teristics, qualities, conditions, and prop-
erties. Examples of common terms in
Role 7 are RATE, SPEED, TIME, PRES-
SURE, TEMPERATURE, INTENSITY,

ROLE 7 (Continued)

MEANINGS (ctd.)

"Y" as a factor affected or influenced by "X"

The "Y" in "Y" is a function of "X"

EXAMPLES

In each example, replace "7" with "on" in connection with the corresponding term in Role 6:

7-BRITTLENESS
7-CREEP BUCKLING
7-CREEP RATE
7-EXTRUDABILITY
7-HOT TEARING
7-IMPACT STRENGTH
7-MECHANICAL PROPERTIES
7-MODES OF VIBRATION
7-NOTCH-TENSILE STRENGTH
7-PHYSICAL PROPERTIES
7-POWER DENSITY
7-RELATIVE HUMIDITY
7-TENSILE STRENGTH
7-WEAR RESISTANCE

EXPLANATIONS (ctd.)

DOSAGE, WEAR RESISTANCE, TENSILE STRENGTH, etc., as well as terms which describe the ability of materials or devices to do something or to have something done to them, such as REPRODUCIBILITY, OPERABILITY, MOLDABILITY, FABRICABILITY, and PERFORMANCE. Only naturally occurring processes such as BUCKLING, CREEP, CRAZING, and CRACKING are indexed in Role 7.

If there are one or more terms indexed in Role 7 in a link, there must also be one or more terms indexed in Role 6 in the same link.

EXCLUSIONS

Materials, operations, processes, devices, equipment, and apparatus are never indexed in Role 7.

A material or mixture itself is never affected - what is affected is a property, quality, characteristic, or condition of the material or mixture. An operation, process, or system is never affected - its reliability, speed, reproducibility, quality, rate, etc., is affected. The performance, reliability, efficiency, etc., of equipment, apparatus, and devices is affected.

ROLE 9

MEANINGS

<p>Material Substance Mixture Property Characteristic Condition Quality Device Equipment Apparatus Method Energy form Data</p>	<p>EITHER WHEN. Passively receiving an operation or process with no change in identity, composition, configuration, molecular structure, physical state, or physical form. OR WHEN: Preceded by the preposition <u>of</u>, <u>in</u>, or <u>on</u> meaning possession of or location in or on.</p>
--	--

EXPLANATIONS

Role 9 is to be used on terms for devices, equipment, apparatus, materials, mixtures, forms of energy, data, and data quantities which passively receive an operation or process or are passively treated or handled in a system and which are the same both before and after the process, operation, treatment, or handling with respect to identity, composition, configuration, molecular structure, physical state, and physical form. Properties, conditions, characteristics, processes, and operations may passively receive operations

ROLE 9 (Continued)

MEANINGS (ctd.)

EXAMPLES

Terms in "9" passively receive the operation or process preceding them.

Testing	9-AIRCRAFT
Conveying	9-COAL
Packaging	9-COMPONENTS
Controlling	9-FLIGHT
Repairing	9-INSTRUMENTS
Measuring	9-LENGTH
Shipping	9-OIL
Analyzing	9-PROPANE
Designing	9-REACTORS
Transmission	9-SOUND
Cleaning	9-TANKS
Mounting	9-TRANSDUCERS
Storing	9-TRANSISTORS
Marketing	9-RADIOS

In each of the following examples, replace the "9" with "of".

Brittleness	9-COPPER
Intensity	9-IRRADIATION
Viscosity	9-PETROLEUM
Geometry	9-SPACE VEHICLES
Permeability	9-SUBSTRATES

In the following examples, replace "9" with "in" or "on":

Liquids	9-CONTAINERS
Argon	9-ELECTRON TUBES
Defects	9-GLASS
Adhesives	9-LABELS
Occlusions	9-PLASTICS
Printing	9-POLYETHYLENE
Instruments	9-SATELLITES
Coatings	9-SURFACES

EXPLANATIONS (ctd.)

and be indexed in Role 9. Primarily, terms in Role 9 receive movements, handlings, examinations, evaluations, designing, etc.

Role 9 when used with a term for a concept implies that the concept possesses a characteristic, property, quality, or condition, or that the material, device, etc., has something on it or in it. For example, "Brittleness 9-COPPER" means that "copper has the condition of brittleness". "Viscosity 9 - PETROLEUM" means the property of "viscosity possessed by petroleum". "Argon 9 - ELECTRON TUBES" describes that there is argon "in electron tubes". "Coatings 9-NICKEL" describes the presence of "coatings on nickel". Frequently Role 9 can be used for terms following the preposition "to".

EXCLUSIONS

If a material, mixture, device, substance, equipment, or apparatus is a means of accomplishment, this may be indicated by the prepositions "by" or "with" or by participle "using", and the term should be indexed with Role 10. When materials, mixtures, devices, substances, equipment, or apparatus enter a process or operation and are therein changed with respect to original identity, original composition, configuration, molecular structure, physical state, or physical form, index as inputs in Role 1, not as passive recipients in Role 9.

The preposition "of" is often used unnecessarily and is the major cause of confusion in using this system of roles. Check carefully each time to determine if the object of the preposition "of" is not actually an input (alloying of Tin, use 1-TIN) or (Chlorination of Ethylene, use 1-ETHYLENE). Check carefully to determine if the object of the preposition "of" is not actually an output (Fabrication of sheeting, use 2-SHEETING) or (Production of Petroleum, use 2-PETROLEUM). The "of" in "by means of" can be handled satisfactorily by converting "by means of" to "using", and then index the term in Role 10.

ROLE 10

MEANINGS

Device
Equipment
Apparatus
Operation
Process
Method
Procedure
Technique
Test method
Analytical method
Process condition
Material
Class of uses of materials
Form of energy
Inspection method

When used as means to accomplish the primary topic of consideration or other objective.

EXPLANATIONS

Use Role 10 on means to accomplish the primary topic of consideration or other objective, such as devices, equipment, apparatus, operations, processes, methods, procedures, techniques, test methods, process conditions (if quantified), materials, classes of uses of materials, forms of energy, and inspection methods. Use Rule 10 on a term for a material and a term for a class of use, as 10-ACETONE and 10-DRYING AGENTS to mean "using acetone as a drying agent" and 10-PAINT and 10-PROTECTIVE COATINGS to mean "using paint as a protective coating".

Role 10 can be used in the sense of employed or utilized, and it can also imply the sense of used up or consumed. In the sense of used up or consumed, en route to being used up or consumed, materials or devices may be changed with respect to original identity, original composition, configuration, molecular structure, physical state, or physical form but this is incidental to the fact that they are put in to accomplish something. Hence, whatever change may occur in or to them is not justification to index them as inputs in Role 1 -- index them as a means of accomplishment in Role 10. Examples include catalysts, explosives, inhibitors, vulcanizing agents, abrasives for polishing or cleaning, acids for cleaning and etching, solder, heat as a form of energy, welding rods, and capsules.

EXAMPLES

In each example, replace the "10" with either "using", "by", "by means of", or "with", or "in" when the meaning is "using".

10-ARC WELDING
10-CAPACITORS
10-CATALYSTS
10-CUPROUS CHLORIDE
10-DISTILLATION
10-ELECTRON MICROSCOPY
10-FIRE-RESISTANT COATINGS
10-MEMBRANES
10-MICROPULVERIZING
10-MICROWAVE SPECTROSCOPY
10-POLARIZING FILTERS
10-SOLID PROPELLANTS
10-SUPER CONDUCTORS
10-TENSIOMETERS

EXCLUSIONS

Because of the possibility of expressing ideas in a variety of combinations of words and word orders, concepts will frequently be discussed as "using steel in the construction of silos" which incorrectly suggests the indexing as 10-STEEL. Despite the wording, steel is an input in a construction, building, or fabrication operation and should be indexed as 1-STEEL, not 10-STEEL.

ROLE 10 (Continued)

EXCLUSIONS (ctd.)

In indexing chemical information, indexers should be alert for statements such as "using hydrogen chloride as the chlorinating agent." This is not indexed as 10-HYDROGEN CHLORIDE, 10-CHLORINATING AGENTS. The hydrogen chloride is a reactant and should be indexed as 1-HYDROGEN CHLORIDE.

ROLE 0

MEANINGS

[See the Section on Bibliographic and Subject Matter Search and Figure 4; also, Reference [4], Section on Query and Search Procedure, pp. 13-18]

EXPLANATIONS

Role 0 is used for the document accession number which covers all bibliographic data included on the LIBRARY DATA TRANSMITTAL (Navships 4909(9-62)) (Figure 4).

APPENDIX C

FILE FORMATS AND KEYPUNCHING INSTRUCTIONS

This Appendix contains keypunching instructions and forms for the various SHARP files. Special notes are included where more explicit instructions are required

CARD LAYOUT FOR PROJECT SHARE

<u>DATA</u>	<u>COLUMNS</u>	<u>REMARKS</u>
<u>Card # 1</u>		
1. Name of Source	1-43	See Note 1, 3, 4, 5
2. Source's report number	44-71	See Note 3, 5, 6
3. Report security classification (U, C, or S)	72	
4. Library accession number	73-78	See note 8
5. Card number (1)	79	
6. Subcard number (0-9)	80	
<u>Card #2</u>		
1. Report title security classification	1-2	See note 10
2. Title of Report	3-60	See Note 4, 5, 7
3. Report security classification (U, C, or S)	72	See Note 16
4. Library accession number	73-78	
5. Card number (2)	79	
6. Subcard number (0-9)	80	
<u>Card #3</u>		
1. Personal author	1-49	See Note 2, 3, 4, 5
2. Economy, Project, or Contract Number		
(a) E, P, or C	50	
(b) Number	51-68	See Note 9
3. Report security classification other than U, C, or S	69-71	
4. Report security classification (U, C, or S)	72	See Note 16
5. Library accession number	73-78	See Note 16
7. Card Number (3)	79	
7. Subcard number (0-9)	80	

<u>DATA</u>	<u>COLUMNS</u>	<u>REMARKS</u>
<u>Card #4</u>		
1. Date		
(a) Covering (YYMMDDYYMMDD)	1-12	See Note 13
(b) Date of Publication (YYMMDD)	13-18	See Note 13
(YY=year; MM=month; DD=day)		
2. Translation number	19-39	See Note 4, 5, 10
3. BUSHIPS program number	40-52	See Note 3, 4, 5, 11
4. BUSHIPS task number	53-57	See Note 3, 4, 5, 11, 12
5. NA Information Report Number	58-71	See Note 4, 5
6. Report security classification (U, C, pr S)	72	See Note 16
7. Library accession number	73-78	See Note 16
8. Card number (4)	79	
9. Subcard number (0-9)	80	
<u>Card #5</u>		
1. Paging		
(a) Volume number or number of pages	1-3	See Note 14
(b) V or P	4	
2. DDC document number	5-18	See Note 4, 5
3. ONI accession number	19-28	See Note 4, 5
4. BUSHIPS identification number	29-38	See Note 4, 5
5. DDC and Bureau limitations (0-9)	39	See Note 13
6. Available at Office of Technical Services (Y or N or blank)	40	
7. Available in micro card file (Y or N or Blank)	41	
8. Subject codes for accession bulletin only	42-46	See Note 3, 5, 15
9. Report security classification	72	See Note 16
10. Library accession number	73-78	See Note 16
11. Card number (S)	79	
12. Subcard number (0-9)	80	

<u>DATA</u>	<u>COLUMNS</u>	<u>REMARKS</u>
<u>Card #6</u>		
1. Descriptive words of content of report	1-71	See Note 4,5
2. Report security classification (U, C, or S)	72	See Note 16
3. Library accession number	73-78	See Note 16
4. Card number (6)	79	
5. Subcard number (0-9)	80	

NOTES

1. Each source is less than or equal to 85 digits. If no asterisk is shown, start name in column 1.
2. Each author is less than or equal to 97 digits. Do not punch comma. Separate card for each author, begin with (*) in first digit.
3. On a basic card, the first digit of each of the following fields must contain an asterisk (*): name of source, author, source report number, BUSHIPS program number, BUSHIPS task number and subject code for accession bulletin. If there is more than one item associated with any of these fields, for example, more than one author, then the additional information may be punched on a continuation card with an asterisk in the first digit of the appropriate field. However, only one item of a repeated field may be listed on each card.
4. A continuation card may be used to extend the following fields: name of source, title of report, author, translation number, BUSHIPS program number, BUSHIPS task number, NA information number, DDC document number, ONI accession number, BUSHIPS identification number, descriptive words of content of report. For this case, an asterisk is not used in the continuation card.
5. The subcard number of the basic card is always zero while the subcard numbers of the continuation cards are numbered sequentially from 1 to 9. The reference material field of any continuation card must be in the same columns as the basic card. There is only one zero card regardless of number of source cards. Data items are not to be duplicated when subcards are required for other fields.
6. The source code field is to be punched in the source report number field (Cols. 44-71) of the first card number of a bulletin. It is preceded by an asterisk (*) in col. 44. If there is a source report number given, it is punched on a continuation card in cols. 44-71 and is also preceded by an asterisk (*). If the source report number has to be continued, it is punched in continuation cards in cols. 44-71 without an asterisk in col. 44, with the data beginning in col. 44. All source codes are punched one to a card, before punching the source report number. If there is only one source report number, use it with the first source name. Punch first report number with first source number and second report number with second source, etc.
7. Do not punch beyond col. 60 when punching the title on the two (2) cards. If the title is longer, divide it at col. 60 or before. Always make sure that you divide between words and do not split words between cards.
8. If less than six digits, precede by zero.
9. Economy, Project or Contract Number is punched in the first card only, unless there are more than one contract number.

10. Space fill after number.
11. An asterisk is punched in col. 1 only when there is data.
12. Task number is an asterisk plus 4 numbers.
13. Numeric (zero fill) or blank.
14. Numeric (precede with zero) or blank.
15. Begins with an asterisk (*), if shown on document.
16. Report Security Classification and Library Accession Number is duplicated from card 1.
17. The work list is punched for all accession numbers for which 3x5 catalog cards and/or accessions bulletins are requested.
18. Deletions. Insert the report security classification and library accession number of the document in the columns labelled as such and complete the form as follows:
 - a. To delete a document from the file, place "\$\$\$\$\$\$" in columns 1-6 of line 1.
 - b. To delete a single card format, place "ZZZZZZ" in columns 1-6 of the row of the corresponding cards and subcard numbers.
 - c. To insert a card format, fill in the line of the appropriate card and subcard number.
 - d. To replace a card format, place the desired information in the line corresponding to the card and subcard number of the item to be replaced.

WORK LIST (See Note 17)

<u>Column</u>	<u>Field</u>	<u>Format</u>
1	Classification	U, C, S or T
2-7	Accession Number	Numeric
8-11	Subject Code	Numeric
12	Request Code	1 = 3x5 cards, 2=Accessions Bulletins, 3 = 3x5 cards and Accessions Bulletins

SUBJECT INDEX FILE

<u>Field</u>	<u>Contents</u>	<u>Instructions</u>
1-7	Role 8	Alpha-Numeric, left justify
8-14	Role 1	" " " "
15-21	Role 2	" " " "
22-28	Role 3	" " " "
29-35	Role 4	" " " "
36-42	Role 5	" " " "
43-49	Role 6	" " " "
50-56	Role 7	" " " "
57-63	Role 9	" " " "
64-70	Role 10	" " " "
** 71	Security Classification	C, S, or U
**72-77	Accession Number	Numbers, zero fill from left
** 78	Linkage	A-Z
** 79	Card Number	a 1 for insertions a 0 for deletions
** 80	Subcard Number	0-9, A-Z

DELETIONS - Punch a deletion card for each item appearing on the sheet. Insert a zero (0) in card number field.

REPLACEMENTS - (1) Punch one deletion card for each different link appearing on a sheet
(2) Punch all other information in correct format for additions.

* See Figure 13 for the file updating worksheet.

** Punch only starred fields for deletions.

PUNCHING INSTRUCTIONS FOR SUBJECT MATTER QUERY CARDS

<u>COLUMN</u>	<u>FIELD</u>	<u>FORMAT</u>
1-5	Line Number	The line number field is numbered consecutively from 1, 2, Each field containing data on the query sheet constitutes a line or a new IBM card. Zero fill from left.
6	Space	Leave Blank
7-9	Query Number	Number in top right corner of form. Precede with zeros. (EX: 005)
10-12	Part Number	Alphabet in top right corner beside number. Precede with zeros. (EX: 00A)
13-15	Role Number	The role number appears above column containing data. Use only those roles filled in. (EX: Role 8 = 008)
16-18	Operation Code	Punch E preceded with zeros. (EX: 00E) unless the word in a field is preceded by the not equal sign (\neq). Then punch NE preceded by zeros. (EX: 0NE)
19-30	Name of item to be retrieved	The format depends on the particular role number being used for selection. For example, if role 8 contains data, then the format for role 8 should be selected for this card. See format chart below. The data word is then punched where the X's appear for that particular role and zeros are punched in columns as shown.

<u>ROLE NUMBER</u>	<u>FORMAT</u>
Col.	19 30
008	X X X X X X X 0 0 0 0 0
001	0 X X X X X X X 0 0 0 0
002	0 0 X X X X X X X 0 0 0
003	0 0 0 X X X X X X X 0 0
004	0 0 0 0 X X X X X X X 0
005	0 0 0 0 0 X X X X X X X
006	X X X X X X X 0 0 0 0 0
007	0 X X X X X X X 0 0 0 0
009	0 0 X X X X X X X 0 0 0
010	0 0 0 X X X X X X X 0 0

PUNCHING INSTRUCTIONS FOR BIBLIOGRAPHIC QUERY CARDS

<u>Column</u>	<u>Field</u>	<u>Format</u>
1-5	Line Number	Numbered consecutively 1, 2, 3,
6	Extension Card	Δ or E, where E denotes extension query card
7-9	Query Number	Numbers, zero fill (From the query form)
10-12	Part Number	Alphabet, zero fill (From the query form)
13-15	Field Code	001 thru 013.
16-18	Operation Code	See operation codes below
19-72	Name of item to be retrieved	See figure 14

Operation Codes

Operation

00E	equal
CNE	not equal
00L	less than
0LE	less than or equal
00G	greater than
0GE	greater than or equal

Notes for Periodical List File

1. Do not punch the decimal point or period in cost field.
2. Punch all marked up corrections shown in red.
3. Only punch the one (1) card for deletions.
4. Punch both one (1) and two (2) cards for corrections codes 1 and 4. See Figure 15.

BUREAU OF SHIPS TECHNICAL LIBRARY
Periodical List File (2-63)

WORKSHEET

Card 1

FIELD	COLUMN	CONTENTS
Reference Code	1	"R", "N", or "Δ"
Binding Code	2	"B", "Δ", or 1-9
Title	3-55	Alpha-Numeric(A/N)-Not all spaces left justify
Addressee	56-60	(A/N)
Routing Code	61	"M" or "L"
Type Code	62	"D", "F", "S", or "G"
Publication Freq.	63-64	(A/N)
Renewal Freq.	65	Numeric (N)
Expiration Date	66-71	A/N
ID Number (Title Code)	72-78	(N) - Right justify (zero fill)
Card Number	79	1
CC	80	1-4 or Blank

Card 2

FIELD	COLUMN	CONTENTS
Quantity	1-2	(N) - Right justify (zero fill)
Cost	3-8	(N) - Right Justify (zero fill)
PR Number	9-12	(N) - 1000-9999
Not Used	13-71	Blank
ID Number (Title Code)	72-78	(N) - Right justify (zero fill)
Card Number	79	2
CC	80	1-4 or Blank

CC # 1 = delete, 2 = insert, 3 = ignore, 4 = replace

Figure 15. Periodical List Worksheet

APPENDIX D

COMPUTER OPERATING INSTRUCTIONS

This Appendix contains the computer operating instructions for each run. The software packages utilized in Project SHARP were IBM's IOCS and 9-Sort which have been added to the Bell Laboratory Monitoring Program (7090) as subprograms. This basic software provides most of the Input/Output and On-Line monitoring operations required.

Separate standard forms are used by the David Taylor Model Basin to serve as instructions to computer operators. Examples of these forms are attached.

7090 SORT ROUTINE

9-SORT

Tape Assignments

<u>Channel A</u>	<u>Unit</u>	<u>Contents</u>	<u>Label</u>	<u>R</u>
	1	BELL		
	5	Blank for Unreadable Blocks		
	6)			
	7}	Blanks for Intermediate Merging		
	8)			
<u>Channel B</u>	2	Original Input		
	5	Original Input		
	6)			
	7}	Blanks for Merging		
	8)			

Notes to Operator:

1. 9-SORT is a BELL run at DTMB.
2. Clock the job in on the BELL system.
3. Clear all panel keys and sense switches.
4. Be sure that all tape units not in use during a run are in the "OFF" position in order to avoid an error in tape reads and writes.
5. Put the 9-Sort card parameter deck in the hopper and press LOAD TAPE key.
6. There will be several HAI TS in the program. If no errors are indicated on the printer or elsewhere, note the location of the halt and press START.
7. At the end of the run, rewind the output tapes and re-initiate the BELL system.
8. It is absolutely necessary that each final output tape be clearly labeled as it is removed from the tape unit as to the tape unit and file sequence of the tape. For example: Tape 001 from Unit B6.
9. If there were UNREADABLE data blocks written on A5, print the tape.
10. All tapes are to be saved from the run.

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL 9-Sort		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EST.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A A B 2 INPUT CTC OUTPUT SEE SHEET REEL NO. FOR IBM 7090 SORT DISPOSITION					

7090 SYSTEM REQUEST - PRMC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EST.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A 5 A 7 B 5 INPUT SH OUTPUT WEEKLY SHARP E1 REEL NO. DISPOSITION					

7090 SYSTEM REQUEST - PRMC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EST.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A 5 A 6 B 5 B 7 A 7 INPUT SHARP IF WEEKLY SHARP OUTPUT UPDATED MASTER SHARP E2 REEL NO. DISPOSITION					

7090 SYSTEM REQUEST - PRMC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL 9-Sort		PAPER (P) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																																				
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.																																				
<input type="checkbox"/> CC <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div> <input type="checkbox"/> PR		PROBLEM NO.		RUN 4 - SORT		CODE																																				
DECK ID		<div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block; text-align: center;">4 - 3 5 4</div>				OPERATOR																																				
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>TAPE UNIT</th> <th>A</th> <th>A</th> <th>B 2</th> <th>B</th> <th>B</th> <th>B</th> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td>SC</td> <td></td> <td></td> <td></td> </tr> <tr> <td>OUTPUT</td> <td></td> <td>SEE</td> <td></td> <td>SHEET</td> <td></td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td>FOR IBM 7090</td> <td></td> <td>SORT</td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						TAPE UNIT	A	A	B 2	B	B	B	INPUT			SC				OUTPUT		SEE		SHEET			REEL NO.		FOR IBM 7090		SORT			DISPOSITION						
TAPE UNIT	A	A	B 2	B	B	B																																				
INPUT			SC																																							
OUTPUT		SEE		SHEET																																						
REEL NO.		FOR IBM 7090		SORT																																						
DISPOSITION																																										

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS		PAPER (P) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																																														
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.																																														
<input type="checkbox"/> CC <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div> <input type="checkbox"/> PR		PROBLEM NO.		RUN 5 - FORMAT		CODE																																														
DECK ID		<div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block; text-align: center;">4 - 3 5 4</div>				OPERATOR																																														
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>TAPE UNIT</th> <th>A 5</th> <th>A 6</th> <th>A 7</th> <th>A 8</th> <th>B 6</th> <th>B 7</th> <th>B 8</th> <th>B 9</th> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td></td> <td></td> <td>SSC</td> <td></td> <td>SHARP</td> <td>MF</td> </tr> <tr> <td>OUTPUT</td> <td>AB</td> <td>3x5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						TAPE UNIT	A 5	A 6	A 7	A 8	B 6	B 7	B 8	B 9	INPUT					SSC		SHARP	MF	OUTPUT	AB	3x5							REEL NO.									DISPOSITION								
TAPE UNIT	A 5	A 6	A 7	A 8	B 6	B 7	B 8	B 9																																												
INPUT					SSC		SHARP	MF																																												
OUTPUT	AB	3x5																																																		
REEL NO.																																																				
DISPOSITION																																																				

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL 9-Sort		PAPER (P) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																																				
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.																																				
<input type="checkbox"/> CC <div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block;"></div> <input type="checkbox"/> PR		PROBLEM NO.		RUN 6 - SORT		CODE																																				
DECK ID		<div style="border: 1px solid black; width: 100px; height: 20px; display: inline-block; text-align: center;">4 - 3 5 4</div>				OPERATOR																																				
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>TAPE UNIT</th> <th>A</th> <th>A</th> <th>B 2</th> <th>B</th> <th>B</th> <th>B</th> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td>ACCESSION</td> <td></td> <td></td> <td></td> </tr> <tr> <td>OUTPUT</td> <td></td> <td>SEE</td> <td></td> <td>SHEET</td> <td></td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td>FOR IBM 7090</td> <td></td> <td>SORT</td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>						TAPE UNIT	A	A	B 2	B	B	B	INPUT			ACCESSION				OUTPUT		SEE		SHEET			REEL NO.		FOR IBM 7090		SORT			DISPOSITION						
TAPE UNIT	A	A	B 2	B	B	B																																				
INPUT			ACCESSION																																							
OUTPUT		SEE		SHEET																																						
REEL NO.		FOR IBM 7090		SORT																																						
DISPOSITION																																										

7090 SYSTEM REQUEST - PRNC-TMB-830

NAME CODE INITIAL		<input checked="" type="checkbox"/> SELL IQCS	FAP IN	<input type="checkbox"/> EXPRESS																									
		<input type="checkbox"/> OTHER	FOR (P)	<input checked="" type="checkbox"/> REGULAR																									
<input checked="" type="checkbox"/> READER	<input type="checkbox"/> PUNCH	NO. OF EXTRA TAPES	RUN NO.	EXT.																									
		RUN 7 - SEPARATE																											
<input type="checkbox"/> CC	<input type="checkbox"/> PR	PROBLEM NO.	CODE	OPERATOR																									
DECK ID		4 - 3 5 4																											
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED VOID TIME <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>TAPE UNIT</td> <td>A 7</td> <td>A 9</td> <td>B 7</td> <td></td> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td>SORTED AS</td> <td></td> </tr> <tr> <td>OUTPUT</td> <td>CLASSIFIED SORTED AS</td> <td>UNCLASSIFIED SORTED AS</td> <td></td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>			TAPE UNIT	A 7	A 9	B 7		INPUT			SORTED AS		OUTPUT	CLASSIFIED SORTED AS	UNCLASSIFIED SORTED AS			REEL NO.					DISPOSITION				
TAPE UNIT	A 7	A 9	B 7																										
INPUT			SORTED AS																										
OUTPUT	CLASSIFIED SORTED AS	UNCLASSIFIED SORTED AS																											
REEL NO.																													
DISPOSITION																													

7090 SYSTEM REQUEST - PRNC-TMB-830

LIBRARY ACCESSIONS BULLETIN									
READER - PUNCH		NO. OF TAPES		EXT.					
PRINTER		CC		PR		CODE			
SS ON				ESTIMATED TIME					
A	B	C	D	E	F	G			
TAPE UNIT		1	2	3	4				
INPUT		CSAB							
OUTPUT									
REEL NO.									
DISPOSITION		EDIT							
OPERATIONS									
PRELIST		TAPE		CARD					
ASSEMBLY		TAPE		TAPE					
POSTLIST		TAPE		PRINT					
COL. B1		MEM. DUMP							
CARD	TAPE	TAPE DUMP							
CARD	CARD	OTHER							
CARD	PRINT	CONTROL CARD							
RUN 8									
PROGRAMMED STOPS									
REMARKS FROM PROGRAMMER									
REMARKS FROM OPERATOR									
PROGRAM FAILURE									
1401 SYSTEM REQUEST PRNC-TMB-877									

3x5 LIBRARY CATALOG CARDS									
READER - PUNCH		NO. OF TAPES		EXT.					
PRINTER		CC		PR		CODE			
SS ON				ESTIMATED TIME					
A	B	C	D	E	F	G			
TAPE UNIT		1	2	3	4				
INPUT		3x5							
OUTPUT									
REEL NO.									
DISPOSITION		EDIT							
OPERATIONS									
PRELIST		TAPE		CARD					
ASSEMBLY		TAPE		TAPE					
POSTLIST		TAPE		PRINT					
COL. B1		MEM. DUMP							
CARD	TAPE	TAPE DUMP							
CARD	CARD	OTHER							
CARD	PRINT	CONTROL CARD							
RUN 9									
PROGRAMMED STOPS									
REMARKS FROM PROGRAMMER									
Use Special paper Loop marked 3x5. Use Special 3x5 card stock. Deck self loading program									
REMARKS FROM OPERATOR									
PROGRAM FAILURE									
1401 SYSTEM REQUEST PRNC-TMB-877									

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL 9-Sort <input type="checkbox"/> OTHER		PAP (M) FORM (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 10 - SORT		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 5		B 2	
		INPUT				P			
		OUTPUT		SEE		SHEET			
		REEL NO.		FOR IBM 7090		SORT			
		DISPOSITION							

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAP (M) FORM (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 11 - FORMAT		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 5		B 6	
		INPUT				SP			
		OUTPUT		E3		SPF			
		REEL NO.							
		DISPOSITION							

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAP (M) FORM (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 12 - UPDATE		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 7		B 9	
		INPUT				SPF		PERIODICAL	
		OUTPUT		PERIODICAL MASTER FILE		P4		MF	
		REEL NO.							
		DISPOSITION							

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE			
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 5		A 6	
		INPUT		PERIODICAL MASTER FILE					
		OUTPUT		REPORT 1					
		REEL NO.							
		DISPOSITION							
7090 SYSTEM REQUEST - PRMC-TMB-830									

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE			
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 6		B 6	
		INPUT		PERIODICAL MASTER FILE					
		OUTPUT		REPORT 2					
		REEL NO.							
		DISPOSITION							
7090 SYSTEM REQUEST - PRMC-TMB-830									

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.			
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE			
<input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME		TAPE UNIT		A 5		A 6	
		INPUT		PER MASTER FILE					
		OUTPUT		UPDATED PERIODICAL MASTER FILE		Rept. 3A		Rept. 3B	
		REEL NO.							
		DISPOSITION							
7090 SYSTEM REQUEST - PRMC-TMB-830									

JCR NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR: <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		RUN 16 - SORT 4 - 3 5 4		CODE	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7080 TIME		TAPE UNIT A A B 2 B 5 INPUT OUTPUT SEE SHEET REEL NO. FOR IBM 7090 SORT DISPOSITION		OPERATOR	

7090 SYSTEM REQUEST - PRNC-TMB-830

JCR NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR: <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		RUN 17 - FORMAT 4 - 3 5 4		CODE	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7080 TIME		TAPE UNIT A 5 A B 5 B 7 INPUT UB OUTPUT SUB E5 REEL NO. DISPOSITION		OPERATOR	

7090 SYSTEM REQUEST - PRNC-TMB-830

JCR NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER FOR: <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		RUN 18 - UPDATE 4 - 3 5 4		CODE	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7080 TIME		TAPE UNIT A 5 A 6 B 5 B 7 INPUT SUBJECT MATTER MASTER FILE OUTPUT UPDATED SUBJECT MATTER FILE E6 REEL NO. DISPOSITION		OPERATOR	

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER (M) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 19 - EDIT		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A 5 A 6 B					
REMARKS ON BACK		INPUT UPDATED SUBJECT MATTER MF SUBJECT MATTER WORKSHEET					
<input type="checkbox"/> NOTES TO OPERATOR		OUTPUT					
<input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER		REEL NO.					
<input type="checkbox"/> PROGRAM FAILURE		DISPOSITION					

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER (M) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 21 - SEARCH		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A 5 A B 3					
REMARKS ON BACK		INPUT SHARP MF					
<input type="checkbox"/> NOTES TO OPERATOR		OUTPUT QA					
<input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER		REEL NO.					
<input type="checkbox"/> PROGRAM FAILURE		DISPOSITION					

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER (M) <input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR	
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO. RUN 22 - SELECT		EXT.	
<input type="checkbox"/> CC <input type="checkbox"/> PR		PROBLEM NO.		4 - 3 5 4		CODE	
DECK ID						OPERATOR	
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE		MAXIMUM ESTIMATED 7090 TIME TAPE UNIT A 5 A B 2					
REMARKS ON BACK		INPUT SHARP MF					
<input type="checkbox"/> NOTES TO OPERATOR		OUTPUT BQA					
<input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER		REEL NO.					
<input type="checkbox"/> PROGRAM FAILURE		DISPOSITION					

7090 SYSTEM REQUEST - PRNC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL 9-Sort <input type="checkbox"/> OTHER		PAPER PORT (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																										
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		PRY.																												
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR																										
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1"> <tr> <td>TAPE UNIT</td> <td>A</td> <td>A</td> <td>B 2</td> <td>B</td> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td>BQA</td> <td></td> </tr> <tr> <td>OUTPUT</td> <td></td> <td>SEE</td> <td>SHEET</td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td>FOR 7090</td> <td>SORT</td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								TAPE UNIT	A	A	B 2	B	INPUT			BQA		OUTPUT		SEE	SHEET		REEL NO.		FOR 7090	SORT		DISPOSITION				
TAPE UNIT	A	A	B 2	B																														
INPUT			BQA																															
OUTPUT		SEE	SHEET																															
REEL NO.		FOR 7090	SORT																															
DISPOSITION																																		

7090 SYSTEM REQUEST - PRMC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER PORT (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																										
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		PRY.																												
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR																										
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1"> <tr> <td>TAPE UNIT</td> <td>A</td> <td>A 4</td> <td>B 8</td> <td>B 4</td> </tr> <tr> <td>INPUT</td> <td></td> <td>DATE TAPE</td> <td>SBQA</td> <td>EDITED QUERY RESULTS</td> </tr> <tr> <td>OUTPUT</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>REEL NO.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								TAPE UNIT	A	A 4	B 8	B 4	INPUT		DATE TAPE	SBQA	EDITED QUERY RESULTS	OUTPUT					REEL NO.					DISPOSITION				
TAPE UNIT	A	A 4	B 8	B 4																														
INPUT		DATE TAPE	SBQA	EDITED QUERY RESULTS																														
OUTPUT																																		
REEL NO.																																		
DISPOSITION																																		

7090 SYSTEM REQUEST - PRMC-TMB-830

JOB NO.		NAME CODE INITIALS		<input checked="" type="checkbox"/> BELL IQCS <input type="checkbox"/> OTHER		PAPER PORT (P)		<input type="checkbox"/> EXPRESS <input checked="" type="checkbox"/> REGULAR																										
<input checked="" type="checkbox"/> READER <input type="checkbox"/> PUNCH		NO. OF EXTRA TAPES		RUN NO.		PRY.																												
<input type="checkbox"/> CC <input type="checkbox"/> PR DECK ID		PROBLEM NO.		4 - 3 5 4		CODE		OPERATOR																										
INPUT <input checked="" type="checkbox"/> ON LINE RQW <input type="checkbox"/> OFF LINE REMARKS ON BACK <input type="checkbox"/> NOTES TO OPERATOR <input type="checkbox"/> ADDITIONAL TAPE ASSIGNMENT FOR OTHER <input type="checkbox"/> PROGRAM FAILURE		MAXIMUM ESTIMATED 7090 TIME <table border="1"> <tr> <td>TAPE UNIT</td> <td>A</td> <td>A</td> <td>B 5</td> <td>B 3</td> </tr> <tr> <td>INPUT</td> <td></td> <td></td> <td>SUBJECT MATTER IS</td> <td></td> </tr> <tr> <td>OUTPUT</td> <td></td> <td></td> <td></td> <td>QB</td> </tr> <tr> <td>REEL NO.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DISPOSITION</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>								TAPE UNIT	A	A	B 5	B 3	INPUT			SUBJECT MATTER IS		OUTPUT				QB	REEL NO.					DISPOSITION				
TAPE UNIT	A	A	B 5	B 3																														
INPUT			SUBJECT MATTER IS																															
OUTPUT				QB																														
REEL NO.																																		
DISPOSITION																																		

7090 SYSTEM REQUEST - PRMC-TMB-830

APPENDIX E

List of David Taylor Model Basin Programmers who worked on aspects of the SHARP System Programs

<u>ROUTINE</u>	<u>TYPE</u>	<u>PROGRAMMER</u>
1	Sort	Generated
2	Format and Sequence Check	Mr. A. Camara
3	Update	Mr. P. Tomlinson
4	Sort	Generated
5	Format and Separate	Mr. D. Edelblute
6	Sort	Generated
7	Separate by Class	Mr. H. Stutz
8	Edit	Mrs. N. Goldberg
9	Edit	Mrs. N. Goldberg
10	Sort	Generated
11	Format and Sequence Check	Mr. B. Wallis
12	Update	Mr. H. Stutz
13	Edit	Mr. M. Siegel
14	Edit	Mr. B. Wallis
15	Edit	Mr. M. Siegel
16	Sort	Generated
17	Format and Consistency Check	Mrs. A. Cooper
18	Update	Mr. C. Fahl
19	Edit	Mrs. C. Siegmann
21	Search	Mr. M. Siegel
22	Select	Mrs. A. Cooper
23	Sort	Generated
24	Edit	Mrs. C. Siegmann
25	Search	Mr. M. Siegel

APPENDIX F

**List of general subject areas and codes
used in the printout of the
Accessions Bulletin**

**[Note: The subject areas and codes herein will
be superseded by the substitution of
the scientific and technological fields
and groups, as listed on DD Form
1498ws (Work Sheet for Research and
Technological Resume)]**

<u>SUBJECT</u>	<u>SUBJECT CODE</u>
Basic Materials, Processes, and Principles	0001
Electronics	0002
Guided Missiles	0003
Mine Countermeasures	0004
Naval Architecture	0005
Nuclear Energy Power Plant for Ship Propulsion	0006
Ship Type Development	0007
Ships Machinery and Equipment	0008
Ships Systems	0009
Submarine Countermeasures	0010
Miscellaneous	0011
Theses	0012
Translations	0013